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ABSTRACT

Reported are data from the first individual interview conducted in 1978 as part of a 3-year study on addition and subtraction using verbal problem solving. The research program is attempting to relate pupil performance on selected arithmetic skills to pupil cognitive processes, instructional materials, and teachers' classroom behaviors. From three schools in Wisconsin that used the Developing Mathematical Processes program, 150 first-grade children were individually administered six problem types (two solvable by addition and four solvable by subtraction) given under four conditions involving size of number and presence or absence of manipulative materials. Answers were coded by model, correctness, and strategy. Discussed first are individual student profiles, followed by a summary of behaviors by task and level. Difficulty levels, response patterns, strategies, and errors are each discussed next. Finally, secondary analyses of data are presented, considering the relationship of strategy to correctness, model to correctness, and consistency of response. Appendices contain sample problem tasks and individual student profiles. (MNS)

Working Paper 281

Results From First Individual Interview (October 1978), Coordinated Study #1

by

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- conducting and synthesizing research to clarify the processes of school-age children's learning and development
- conducting and synthesizing research to clarify effective approaches to teaching students basic skills and concepts
- developing and demonstrating improved instructional strategies, processes, and materials for students, teachers, and school administrators
- providing assistance to educators which helps transfer the outcomes of research and development to improved practice in local schools and teacher education institutions

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WISCONSIN RESEARCH AND DEVELOPMENT
CENTER FOR INDIVIDUALIZED SCHOOLING

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A major aim of mathematical instruction is to enable students to acquire concepts and skills requisite for solving problems of many types. A principle goal of mathematical education research is to understand how children acquire those concepts and skills and to understand how selected pedagogical and psychological factors are related to their acquisition. The Mathematics Work Group of the Wisconsin Research and Development Center for Individualized Schooling is presently conducting a program of research focused on a small set of those concepts and skills. Our interest lies in arithmetical learning, and in particular, in the acquisition of concepts and skills related to addition and subtraction of whole numbers.

The research program is attempting to relate pupil performance on selected arithmetic skills to pupil cognitive processes, instructional materials, and teachers' classroom behaviors. The interrelationship of these variables is depicted in Figure 1. Using this framework, we are proceeding to:

1. identify important addition and subtraction skills;

2. review past empirical data or collect new data on these skills;

3. re-examine these mathematical skills and hypothesize how they are related to underlying cognitive skills;

4. examine the instructional materials designed to teach these skills; and

5. conduct a series of empirical studies on the appropriateness of particular teacher classroom behaviors, the appropriateness of instructional materials, and the relationship of specific cognitive skills to

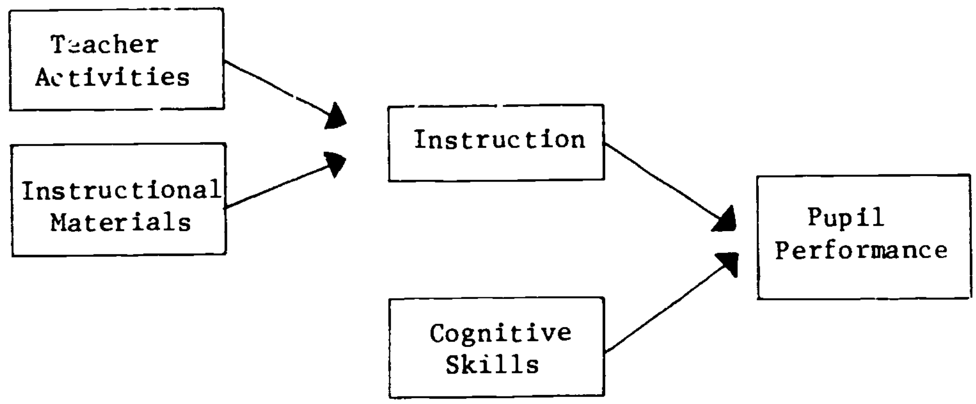

Figure 1. Factors influencing pupil performance.

mathematical skills.

The work of the Mathematics Work Group is built around the conceptual framework exemplified in Figure 1. The empirical and theoretical investigations generally involve two or more of the factors depicted, and have been organized into four major categories. These are a conceptual paper series, a set of short empirical studies, a major longitudinal study, and an invitational conference of scholars.

This paper relates to the longitudinal study. Approximately 150 students in three separate schools have been identified as subjects for the study and are being followed for about three years. Pupil performance will be measured in several ways:

1. Individual interviews. At several times during each school year, individual children are administered a set of problem tasks dealing with addition and subtraction. The interviewer attempts to ascertain the children's solution strategy, correctness of answer, type of errors made, and modeling procedures.

2. Group administered paper-and-pencil tests. There are two separate categories of tests:

   a. Achievement monitoring. These tests measure pupil progress toward a set of performance objectives that are contained in the instructional materials. By means of matrix sampling procedures, estimates are made of group performance. Achievement monitoring tests are given shortly after the completion of the instructional units related to arithmetic objectives.

   b. Topic inventories. These are very short tests that measure pupil progress toward mastery of the objectives of a specific instructional unit, or topic. Every subject takes the same test, resulting in a measure of individual performance.

Instruction and classroom environment are assessed by direct classroom observation of teacher actions, pupil behaviors, and instructional materials. A trained observer is present each day the instructional units, or topics, dealing with arithmetic objectives are being used. Organizational and grouping measures are noted, along with indications of interactions between teacher and pupils, and among pupils. Measures of pupil engaged time are estimated by observing six target students.

The purpose of this paper is to report on the data from the first round of individual interviews for Coordinated Study #1, which were carried out during October 1978. In the first major section we present all the background information on subjects and the manner of data collection. In the following two major sections, summaries and interpretations of the data are given. Some of the actual data collected in the interviews appears in the Appendices.

Background Information

This section contains background information needed to understand the data summaries given in the next section. As indicated in the various subsections, greater detail may be obtained by referring to other reports from the Mathematics Work Group.

Population and Curriculum Materials

The first interview of individual children was carried out during the period October 16-20, 1978, at the three participating schools:

School 1: a public school in Monona, Wisconsin.

School 2: a public school in Madison, Wisconsin.

School 3: a parochial school in Madison, Wisconsin.

The subjects for the study consisted of 144 first grade students, all from predominantly middle class areas, who had parental permission to participate in the interviews. Table 1 presents the number of children who participated in the study in each school and information about their age and sex.

Each of the schools used as their mathematics curriculum the Developing Mathematical Processes (DMP) program (Romberg, Harvey, Moser, and Montgomery, 1974). The following sequence of topics was suggested to the eight teachers involved in the study: 15, 17, 19, 20, 21/23, 24, S-1, 26, S-2, 22, S-3, 28. Most teachers also did Topics 16 and 18. Topics S-1, S-2, and S-3 were specially prepared for Coordinated Study #1 (See Kouba and Moser, Note 1).

The interviews were begun following instruction in Topic 19. By this time in their mathematics instruction, the children had been introduced to naming and ordering the whole numbers 0-10. However, they had had no formal instruction in symbolically solving addition or subtraction problems.

Interview Tasks

The interview consisted of six problem types (tasks) given under four conditions. The four conditions are described later. The six types included two problems solvable by addition of the two given numbers and four problems solvable by subtraction of the two given numbers. The characterization for these six problem types is detailed in Moser (Note 2) and in Carpenter and Moser (Note 3).

Table 2 presents representative problems and the order in which the

Table 1

Number and Age of Population by School

	School 1	School 2	School 3	Total
Number of children	59	50	35	144
Mean age	6 yr. 6 mo.	6 yr. 6 mo.	6 yr. 8 mo.	6 yr. 6 mo.
Maximum age	7 yr. 3 mo.	7 yr. [illegible] mo.	7 yr. 3 mo.	7 yr. 3 mo.
Minimum age	5 yr. 10 mo.	5 yr. 11 mo.	6 yr. 0 mo.	5 yr. 10 mo.
Male	32	26	24	82
Female	27	24	11	62

problems were administered to the children. The actual wording for each problem type differed in the four conditions, but the semantic structure remained constant. The actual problems administered are given in Appendix A.

Within each problem, two of three numbers from a number triple (x, y, z) defined by $x + y = z$, $x < y < z$, were given. In the two addition problems x, y were presented, with the smaller number x always given first. In the four subtraction problems, z and the larger addend y were presented. The order of presentation of y and z varied among problem types

The six problem types were presented under four conditions that result from crossing smaller numbers vs. larger numbers with presence vs. absence of manipulative materials. Figure 2 shows these four conditions with the labels assigned to them. In the b+ and c+ conditions approximately 30 small plastic cubes about equally divided between blue cubes and orange cubes were available to the child to use as manipulatives if desired.

The actual number triples used in the problems are listed in Table 3. We hypothesized before the interviews began that the four conditions would constitute different levels of difficulty with the b+ condition proving the easiest and the c- the most difficult. The ordering of difficulty of b- and c+ was left to the empirical results. The four conditions became known as the four levels, and that terminology will be used in the remainder of this paper.

The assignment of the number triples (small and large domains) to problem types involved a six-by-six Latin square design resulting in six sets of the six problem types. These sets were uniformly and randomly distributed across subjects. The Latin squares for the small number domain (b) and the large

Table 2

Representative Problem Types

Task 1.	Joining (Addition)	Wally had 3 pennies. His father gave him 5 more pennies. How many pennies did Wally have altogether?
Task 2.	Separating (Subtraction)	Tim had 11 candies. He gave 7 candies to Martha. How many candies did Tim have left?
Task 3.	Part-Part-Whole Missing Addend (Subtraction)	There are 6 children on the playground. 4 are boys and the rest are girls. How many girls are on the playground?
Task 4.	Part-Part-Whole (Addition)	Sara has 6 sugar donuts. She also has 9 plain donuts. How many donuts does Sara have altogether?
Task 5.	Comparison (Subtraction)	Joe has 3 balloons. His sister Connie has 5 balloons. How many more balloons does Connie have than Joe?
Task 6.	Joining Missing Addend (Subtraction)	Kathy has 5 pencils. How many more pencils does she have to put with them so she has 7 pencils altogether?

Presence of manipulatives		smaller	larger
	with	b+	c+
	without	b-	c-

Figure 2. Conditions for nonsymbolic problem types.

Table 3

Listing of Number Triples Used in Verbal Problems

Smaller numbers	Larger numbers
2-3-5	3-8-11
2-4-6	4-7-11
2-5-7	5-7-12
3-4-7	4-9-13
3-5-8	6-8-14
3-6-9	6-9-15

number domain (c) are presented in Tables 4 and 5 respectively. The number in the box (☐) in each entry represents the solution the children were to find. The order of the other two given numbers in the tables corresponds to the order in which those numbers appeared in the problem (cf. Table 2). The assignment of problem sets to subjects is listed in Appendix C.

Task sets for a particular level were assigned to child ı so that the same number triple did not occur in the same problem type (task) in any subsequent interview.

Interview Method

Nine trained interviewers (see Martin & Moser, Note 4 for details of interviewer training and reliability) administered the interviews. The entire interview process for all schools took one week, the 16th to 20th of October 1978. Two or three interviewers worked at a given school on each day. Interviews began soon after school started and continued through the day, with the usual breaks at lunch and recess. Table 6 details the assignment of interviewers to schools.

Each interviewer was able to conduct 8 to 18 interviews in a day, depending on the schools' schedules and on the task level. (Level c tasks took longer than level b tasks.) At the schools the interviewers were assigned interview areas, which, for the most part, were quiet rooms separate from distracting activities.

The interviewers went to the classroom to get a child, and they visited together on the way to the interview area. A gemoetric warm-up exercise preceded the first task. The verbal tasks were reread to the child as often as necessary so that remembering the given numbers or relationships caused

Table 4

b+ and b- Number Triples

Set Number	Task					
	1	2	3	4	5	6
1	3,6, 9	7,5, 2	5,3, 2	2,4, 6	4,7, 3	5,8, 3
2	3,5, 8	7,4, 3	6,4, 2	3,6, 9	3,5, 2	5,7, 2
3	2,5, 7	8,5, 3	9,6, 3	3,4, 7	4,6, 2	3,5, 2
4	3,4, 7	6,4, 2	8,5, 3	2,3, 5	5,7, 2	6,9, 3
5	2,4, 6	5,3, 2	7 5, 2	3,5, 8	6,9, 3	4,7, 3
6	2,3, 5	9,6, 3	7,4, 3	2,5, 7	5,8, 3	4,6, 2

Table 5

c+ and c- Number Triples

Set Number	Task					
	1	2	3	4	5	6
1	6,9, 15	13,9, 4	11,8, 3	4,7, 11	7,12, 5	8,14, 6
2	6,8, 14	12,7, 5	11,7, 4	6,9, 15	8,11, 3	9,13, 4
3	4,9, 13	14,8, 6	15,9, 6	5,7, 12	7,11, 4	8,11, 3
4	5,7, 12	11,7, 4	14,8, 6	3,8, 11	9,13, 4	9,15, 6
5	4,7, 11	11,8, 3	13,9, 4	6,8, 14	9,15, 6	7.12, 5
6	3,8, 11	15,9, 6	12,7, 5	4,9, 13	8,14, 6	7,11, 4

Table 6

Interviewer School Assignment

Interviewer Code #	Date				
	10/16	10/17	10/18	10/19	10/20
12				School 3	School 3
27				School 1	
30	School 2	School 2	School 2	School 3	
32	School 1	School 1	School 1		
34	School 1	School 1	School 1		
41					School 3
45	School 2		School 1 pm		School 3
57		School 2			
58		School 2	School 1 am		

no difficulty.

An individual interview required two sessions, one for b+ and b-, and the other for c+ and c- tasks. The sessions lasted 10-20 minutes each, with each child receiving the same sequence of problems. No child was interviewed twice in one day.

If a child had extreme difficulty in responding to b+ tasks, the interview was broken off at that level. After each level, the interviewer decided whether the child should proceed to the next level in the sequence b+, b-, c+, c-.

Coding Subject Responses

All of the possible student responses are presented in detail in Cookson and Moser (Note 5). Only a brief description is presented here. The coding sheet upon which responses were recorded is shown in Figure 3.

Model

C The child used cubes to model (all or part of) the problem

F The child used fingers to model.

N The child used no physical model.

O The child used some other physical model, such as chairs, numerals on a clock face.

Correctness

Y The answer was correct.

N The answer was not correct.

UN Uncodable: The child gave an answer, but the interviewer was unable to identify the strategy used.

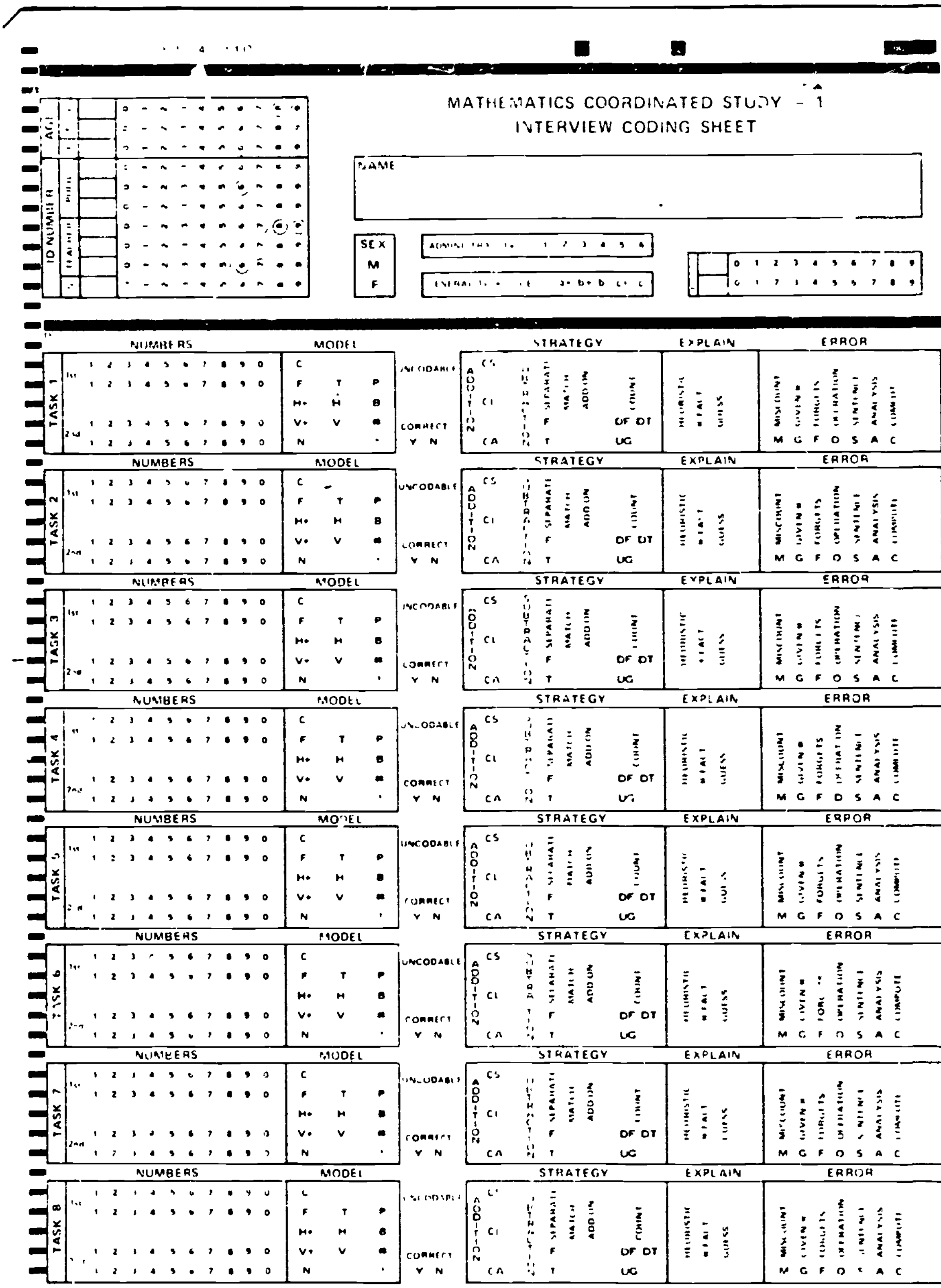

Figure 3. Electronically scored interviewer coding sheet.

Strategy

Addition:

CS Counting On from Smaller: When counting cubes, fingers, or mentally, the counting sequence began either with the smaller number (first number given in the story) or the successor of that number.

CL Counting On from Larger: The counting sequence began with the larger (second) given number or with the successor of that number.

CA Counting All: The child counted the complete union of the sets represented in the problem, with counting sequence started at "one, two, ..."

Subtraction:

F Separate From: The child models the larger given set and then takes away or separates, one at a time, a number of cubes or objects equal to the smaller given number in the problem. Counting the remainder set gives the answer.

T Separate To: After the larger set is modeled, the child removes cubes or objects one at a time until the remainder is equal to the second given number in the problem. Counting the number of objects removed gives the answer.

MA Match: The child puts out two sets of cubes or objects, each set standing for one of the given numbers. The sets are then matched one-to-one. Counting the excess of the larger set over the smaller set gives the answer.

AO Add On: The child sets out a number of cubes or objects equal to the smaller given number (an addend). The child then adds cubes to that set one at a time until the new collection is equal to the larger given number. Counting the number of cubes added on gives the answer.

DF Count Down From: A child initiates a backwards counting sequence beginning with the larger given number. The backwards counting sequence contains as many counting number words as the smaller given number. The last number uttered in the counting sequence is the answer.

DT Count Down To: A child initiates a backwards counting sequence beginning with the larger given number. The sequence ends with the given smaller number. By keeping track of the number of counting words uttered in this sequence, the child determines the answer to be the number of counting words used in the sequence.

UG Count Up from Given: A child initiates a forward counting sequence beginning with the smaller given number. The sequence ends with the larger given number. Again, by keeping track of the number of counting words uttered in sequence, the child determines the answer.

Addition and Subtraction (Explain or Mental Processes):

HU Heuristic: Heuristic strategies were employed to generate solutions from a small set of known basic facts. These strategies usually were based on doubles or numbers whose sum was 10.

#F Number Fact: The child gave a correct answer with the justification that it was the result of knowing some basic addition/subtraction fact.

GU Guess: The child gave an answer with the justification that it was the result of guessing.

Error:

M Miscount: The child miscounted in some way.

G (CI) Gi en Number: The child responded that the answer was one of the two numbers given in the problem.

F Forgets: The child forgot one of the given numbers and thereby found an incorrect answer.

O (OP) Operation: The child used an addition strategy in a problem that must be solved through subtraction, or a subtraction strategy was employed in an addition problem.

None of the other items under model, strategy, and error on the coding sheets was used for this interview.

Presentation of the Data

Data were collected on children's behavior following presentation of a specific verbal problem. The six different verbal problem types were presented at four different levels, resulting in a maximum of 24 tasks for an individual child. For reasons to be explained later, not all children received all tasks. Of the 144 children who began the interviews only 55 were administered the complete set of 24 tasks.

This section begins with a discussion of individual student profiles, which comprise the basic raw data, followed by a summary of pupil response data. Several important aspects of the summary data are isolated for contrast and comment. The following major section will present some secondary analyses of combined data.

Individual Student Profiles

A record of each subject's response to the 24 tasks was compiled from the coding sheets. These profiles are the basis for all other statistical information appearing in this paper. The profiles for all subjects are contained in Appendix B. Figure 4 provides an example of a student profile.

For each task at each level, the four coded entries in order from left to right are model correctness, strategy, and error. The abbreviations used are explained in the previous section. In the strategy column (as in much of the data analysis for this study) Uncodable (UN), Given Number (GI), and Operation (OP) were treated as strategies.

The hundreds digit of the student ID number identifies which school the student attended: 1, 2, or 3 (see Table 1).

The actual problem and numbers used in the problem for a given level and task can be obtained by using the following procedure. For example, what was the actual problem read to Student 153 for Task 2 at the b- level?

1. Use Appendix A, Problem Tasks by Level, to find the exact wording for Task 2 at the b- level:

> Joan had ___ apples.
> She gave ___ apples to Louise.
> How many apples did Joan have left?

2. Use Appendix C, Number Set Assignment, to find what set was assigned to Student 153 at the b- level. The entry in the b- column for ID #153 is 5.

3. Use Table 4, b+ and b- Number Triples, to find what number triple was assigned to set 5, Task 2. The entry in this table is 5, 3, $\boxed{2}$, where $\boxed{2}$ indicates that 2 is the correct solution. Therefore, Student #153 was given the following problem for Task 2, level b-:

> Joan had 5 apples.
> She gave 3 apples to Louise.
> How many apples did Joan have left?

Student ID Number

153		Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
Level	b+	C N UN -	C Y F -	C Y F -	C Y CA -	C N GI GI	C Y AO -
	b-	F Y CA -	F Y F -	- ? ? -	F Y CA -	N N GI GI	- ? ? -
	c+	C N CA M	C Y F -	C Y F -	C Y CA -	C N MA F	C Y AO -
	c-	- ? ? -	- ? ? -	- ? ? -			

Task 1 entries, left to right: model, correct, error, strategy

No entry: the interview was ended because the child was evidently confused

Figure 4. Sample student profile.

Looking at Figure 4, we can reconstruct this child's behavior. The first F indicates fingers were used as a model. The next entry, Y, indicates the problem was solved correctly. This accounts for the hyphen in the fourth column, indicating no error. The F in the third column indicates the child used a Separating From strategy. This means the child initially raised 5 fingers, then lowered 3 of them. Whether this lowering of 3 was done all at once or one at a time cannot be determined from the coding procedure. At any rate, the child reported the two remaining upraised fingers as representing the answer of 2.

Some general understanding of individual students can be achieved by looking at a profile. For example, when considering Figure 4 for Student 153, one might conclude:

1. The student was often confused when no cubes were available to model the problem (a sizeable number of ? in the b- and c- rows).

2. Task 5 was interpreted incorrectly at first by the student (a given number was the response in levels b+ and b-, but an appropriate strategy of matching was used in level c+).

3. The student consistently uses a Counts All strategy when adding with physical objects, although there is an uncodable entry.

<u>A Summary of Behaviors by Task and Level</u>

Each of the four major categories of responses - modeling, correctness, strategy, and error - have been summarized for each of the 24 tasks presented. As indicated in the first major section of this paper, a six-by-six Latin square design was used to distribute the number triples across tasks and across subjects. An initial, informal statistical analysis of the number triples as a variable affecting subject responses showed that the triples have little effect. The triples 2, 3, 5 and 3, 8, 11 appeared to be somewhat easier than the other triples; however, these were spread uniformly across tasks, so there was little effect on the overall percentages of correct solutions.

Three population subsets. The general goal for the interviews was to present each child with the b+ and b- problems during the first interview session and with the c+ and c- problems during the second session a day or two later. However, not all children were capable of solving all problems. The interviewer had the responsibility to determine at what point a particular level was inappropriate for a child. These guidelines were used:

1. If during the b+ portion of the interview the child fails to use any coherent or identifiable strategies while trying to solve three of the first four problems, terminate the b portion and go to several very small number "success" problems.

2. If the child solves two of the first four b+ problems, but is baffled by the last two problems, i.e., solves two of the six problems, terminate the b portion of the interview and go on to "success" problems.

The interview was terminated, not because three of the four problems were incorrect, but because the child was perplexed by the problem and employed highly inappropriate strategies or because the interviewer was unable to determine what strategies were being employed.

3. If the child solved at least two of the first four and at least one of the last two of the b+ problems, present the b- problems. The b- portion should be completed unless the child cannot solve three of the first four

problems.

4. The decision whether the child should go on to the c portion was made at the end of the b interview.

The procedure for determining whether to terminate the c+ or c- level interview followed the same guidelines as those given above. The overriding issue was always the well-being of the child. It would have been unfair to interview further any child who was frustrated or unduly confused by the problems. In a few cases, a decision was made to branch only to c+ problems for some children who relied heavily on physical modeling and did well with the b+ problems, but failed to solve b- problems. For these children, then, it was inferred that they could not solve c- problems but that c+ problems might be within their problem solving abilities.

As a result of the policy of terminating the interview before completion for many children, three sets of subjects were identified.

Total population N=144. This is the total interview population and consists of all children who were interviewed, no matter when the interview terminated.

Real population $55 \leq N \leq 144$. This is the number of subjects who actually were administered each task. This number can change for each task or level.

Successful population N=55. This is the number of subjects who were administered all 24 tasks.

The results describe only the Total population, for that is the most representative of the childrens' responses. Although the decisions to terminate interviews resulted in incomplete data for some students, the decision rules were designed so that it is valid to assume that the child would have given incorrect answers or used uncodable strategies on the questions that were presented. That is, the child consistently had been giving uncodable incorrect answers or was simply confused on all previous problems. Thus, it was a reasonable assumption that subsequent responses would follow the same pattern.

The statistics for the real and the successful population have been compiled and a copy may be obtained by writing the Mathematics Work Group at the R & D Center.

A table for each of the six tasks is presented (Tables 7-12). All four levels for each task are contained in the same table. The uncodable (UN) and confused (?) responses are included in the strategy category. All data are based on the total of 144 subjects.

Levels of Difficulty

Prior to administration of the interviews, it was hypothesized that the four interview conditions, b+, b-, c+, c-, would represent sequential levels of difficulty. The number of students responding correctly to each task under each condition support this hypothesis. Table 13 shows the almost perfect ordering of difficulty for all tasks across all levels with the very slight aberration for Task 3 between b- and c+.

Comparative Difficulty of Addition vs. Subtraction

Results from the first interview are consistent with previous research findings that addition tends to be easier than subtraction. The average number of correct responses per level for the two addition problems was compared to the average number of correct responses for all four subtraction problems. Since two of the subtraction problems, Task 3; Part-Part-Whole,

Table 7

Task 1 (Addition-Joining)

Number (%) of Children Coded for a Particular Behavior

		Level			
		b+	b-	c+	c-
C	Cubes	66(46%)	0(0%)	77(53%)	0(0%)
F	Fingers	15(10%)	66(46%)	6(4%)	60(42%)
N	No Action	63(44%)	52(36%)	18(13%)	25(17%)
O	Other	0(0%)	0(0%)	0(0%)	1(1%)
Y	Correct	96(67%)	90(63%)	68(47%)	44(31%)
UN	Uncodable	26(18%)	16(11%)	10(7%)	17(12%)
?	Confusion	0(0%)	0(0%)	1(1%)	6(4%)
CS	Counts On from Smaller	13(9%)	11(8%)	5(3%)	11(8%)
CL	Counts On from Larger	9(6%)	8(6%)	11(8%)	12(8%)
S	Subitizing	0(0%)	0(0%)	0(0%)	0(0%)
CA	Counts All	70(49%)	60(42%)	67(47%)	29(20%)
HU	Heuristic	0(0%)	8(6%)	3(2%)	2(1%)
#F	Number Fact	14(10%)	10(7%)	1(1%)	0(0%)
GU	Guess	6(4%)	3(2%)	1(1%)	9(6%)
GI	Given Number	6(4%)	2(1%)	1(1%)	3(2%)
OP	Wrong Operation	0(0%)	0(0%)	0(0%)	1(1%)
M	Miscount	12(8%)	11(8%)	19(13%)	12(8%)
F	Forgets Data	5(3%)	6(4%)	0(0%)	0(0%)
	Not administered	0(0%)	26(18%)	44(31%)	54(38%)

Table 8

Task 2 (Subtraction-Separating)

Number (%) of Children Coded for a Particular Behavior

		Level			
		b+	b-	c+	c-
C	Cubes	83(58%)	0(0%)	84(58%)	0(0%)
F	Fingers	9(6%)	67(47%)	3(2%)	49(34%)
N	No Action	52(36%)	49(34%)	13(9%)	35(24%)
O	Other	0(0%)	1(1%)	0(0%)	1(1%)
Y	Correct	92(64%)	74(51%)	60(42%)	24(17%)
UN	Uncodable	37(26%)	28(19%)	9(6%)	26(18%)
?	Confusion	0(0%)	1(1%)	0(0%)	5(3%)
F	Separate from	72(50%)	53(37%)	81(56%)	33(23%)
T	Separate to	0(0%)	0(0%)	0(0%)	0(0%)
MA	Match	0(0%)	0(0%)	0(0%)	1(1%)
AO	Add On	3(2%)	1(1%)	1(1%)	0(0%)
DF	Count Down from	6(4%)	7(5%)	2(1%)	6(4%)
UG	Count Up from Given	3(2%)	3(2%)	0(0%)	1(1%)
DT	Count Down to	0(0%)	3(2%)	1(1%)	2(1%)
HU	Heuristic	1(1%)	5(3%)	1(1%)	1(1%)
#F	Number Fact	7(5%)	9(6%)	1(1%)	1(1%)
GU	Guess	7(5%)	1(1%)	2(1%)	11(8%)
GI	Given Number	4(3%)	5(3%)	1(1%)	3(2%)
OP	Wrong Operation	4(3%)	2(1%)	1(1%)	0(0%)
M	Miscount	10(7%)	10(7%)	25(17%)	20(14%)
F	Forgets Data	3(2%)	0(0%)	0(0%)	1(1%)
	Not administered	0(0%)	26(18%)	44(31%)	54(38%)

Table 9

Task 3 (Subtraction-Part-Part-Whole, missing addend)

Number (%) of Children Coded for a Particular Behavior

		Level			
		b+	b-	c+	c-
C	Cubes	77(53%)	0(0%)	73(51%)	0(0%)
F	Fingers	10(7%)	60(42%)	4(3%)	49(34%)
N	No Action	56(39%)	50(35%)	23(16%)	33(23%)
O	Other	0(0%)	0(0%)	0(0%)	2(1%)
Y	Correct	67(47%)	50(35%)	51(35%)	19(13%)
UN	Uncodable	45(31%)	32(22%)	23(16%)	28(19%)
?	Confusion	1(1%)	8(6%)	0(0%)	7(5%)
F	Separate from	41(28%)	32(22%)	55(38%)	19(13%)
T	Separate to	1(1%)	1(1%)	0(0%)	0(0%)
MA	Match	1(1%)	0(0%)	0(0%)	0(0%)
AO	Add On	10(7%)	6(4%)	7([illegible]%)	4(3%)
DF	Count Down from	1(1%)	1(1%)	2(1%)	0(0%)
UG	Count Up from Given	7(5%)	5(3%)	3(2%)	11(8%)
DT	Count Down to	1(1%)	1(1%)	0(0%)	0(0%)
HU	Heuristic	2(1%)	4(3%)	3(2%)	2(1%)
#F	Number Fact	5(3%)	3(2%)	0(0%)	0(0%)
GU	Guess	8(6%)	5(3%)	5(3%)	14(10%)
GI	Given Number	18(13%)	17(12%)	2(1%)	5(3%)
OP	Wrong Operation	3(2%)	3(2%)	0(0%)	0(0%)
M	Miscount	11(8%)	9(6%)	18(13%)	18(13%)
F	Forgets Data	1(1%)	2(1%)	1(1%)	2(1%)
	Not administered	0(0%)	26(18%)	44(31%)	54(38%)

Table 10

Task 4 (Addition-Part-Part-Whole)

Number (%) of Children Coded for a Particular Behavior

		Level			
		b+	b-	c+	c-
C	Cubes	85(59%)	0(0%)	77(53%)	0(0%)
F	Fingers	13(9%)	58(47%)	6(4%)	56(39%)
N	No Action	46(32%)	50(35%)	16(11%)	19(13%)
O	Other	0(0%)	0(0%)	0(0%)	0(0%)
Y	Correct	108(75%)	92(64%)	72(50%)	41(28%)
UN	Uncodable	29(20%)	14(10%)	11(8%)	14(10%)
?	Confusion	0(0%)	0(0%)	1(1%)	1(1%)
CS	Counts On from Smaller	9(5%)	8(6%)	4(3%)	12(8%)
CL	Counts On from Larger	8(6%)	13(9%)	5(3%)	11(8%)
S	Subitizing	0(0%)	0(0%)	0(0%)	0(0%)
CA	Counts All	84(58%)	62(43%)	74(51%)	25(17%)
HU	Heuristic	4(3%)	5(3%)	2(1%)	1(1%)
#F	Number Fact	8(6%)	11(8%)	2(1%)	1(1%)
GU	Guess	2(1%)	4(3%)	1(1%)	5(3%)
GI	Given Number	2(1%)	1(1%)	0(0%)	5(3%)
OP	Wrong Operation	0(0%)	0(0%)	0(0%)	1(1%)
M	Miscount	9(6%)	7(6%)	14(10%)	10(7%)
F	Forgets Data	6(4%)	6(4%)	1(1%)	3(2%)
	Not administered	0(0%)	26(18%)	44(31%)	68(47%)

Table 11

Task 5 (Subtraction-Comparison)

Number (%) of Children Coded for a Particular Behavior

		Level			
		b+	b-	c+	c-
C	Cubes	74(51%)	0(0%)	68(47%)	0(0%)
F	Fingers	10(7%)	55(38%)	5(3%)	28(19%)
N	No Action	47(33%)	55(38%)	22(15%)	31(22%)
O	Other	0(0%)	0(0%)	0(0%)	0(0%)
Y	Correct	75(52%)	61(42%)	5[illegible](38%)	29(20%)
UN	Uncodable	32(22%)	29(20%)	11(8%)	14(10%)
?	Confusion	2(1%)	1(1%)	2(1%)	3(2%)
F	Separate from	21(15%)	10(7%)	18(13%)	2(1%)
T	Separate to	2(1%)	1(1%)	1(1%)	1(1%)
MA	Match	18(13%)	2(1%)	26(18%)	0(0%)
AO	Add On	10(7%)	16(11%)	6(4%)	5(3%)
DF	Count Down from	1(1%)	0(0%)	0(0%)	1(1%)
UG	Count Up from Given	9(6%)	17(12%)	9(6%)	18(13%)
DT	Count Down to	0(0%)	1(1%)	1(1%)	1(1%)
HU	Heuristic	1(1%)	2(1%)	1(1%)	3(2%)
#F	Number Fact	4(3%)	6(4%)	1(1%)	1(1%)
GU	Guess	2(1%)	5(3%)	6(4%)	5(3%)
GI	Given Number	26(18%)	19(13%)	12(8%)	5(3%)
OP	Wrong Operation	5(3%)	2(1%)	3(2%)	2(1%)
M	Miscount	5(3%)	4(3%)	11(8%)	6(4%)
F	Forgets Data	1(1%)	0(0%)	3(2%)	0(0%)
	Not administered	11(8%)	33(23%)	47(33%)	83(58%)

Table 12

Task 6 (Subtraction-Joining, missing-addend)

Number (%) of Children Coded for a Particular Behavior

		Level			
		b+	b-	c+	c-
C	Cubes	73(51%)	0(0%)	75(52%)	0(0%)
F	Fingers	13(9%)	63(44%)	3(2%)	35(24%)
N	No Action	44(31%)	47(33%)	19(13%)	20(14%)
O	Other	0(0%)	0(0%)	0(0%)	0(0%)
Y	Correct	92(64%)	86(60%)	56(39%)	36(25%)
UN	Uncodable	21(15%)	10(7%)	11(8%)	13(9%)
?	Confusion	1(1%)	1(1%)	0(0%)	0(0%)
F	Separate from	6(4%)	0(0%)	7(5%)	0(0%)
T	Separate to	0(0%)	0(0%)	0(0%)	0(0%)
MA	Match	2(1%)	0(0%)	5(3%)	0(0%)
AO	Add On	60(42%)	53(37%)	45(31%)	10(7%)
DF	Count Down from	0(0%)	0(0%)	0(0%)	0(0%)
UG	Count Up from Given	15(10%)	28(19%)	12(9%)	26(18%)
DT	Count Down to	0(0%)	1(1%)	0(0%)	0(0%)
HU	Heuristic	2(1%)	2(1%)	2(1%)	2(1%)
#F	Number Fact	7(5%)	9(6%)	2(1%)	1(1%)
GU	Guess	3(2%)	2(1%)	5(3%)	1(1%)
GI	Given Number	11(8%)	4(3%)	5(3%)	2(1%)
OP	Wrong Operation	0(0%)	1(1%)	2(1%)	0(0%)
M	Miscount	8(6%)	7(5%)	18(13%)	6(4%)
F	Forgets Data	2(1%)	3(2%)	3(2%)	0(0%)
	Not administered	16(11%)	33(23%)	47(33%)	89(62%)

Table 13

Number of Correct Responses Per Task Across Levels

	Level			
Task	b+	b-	c+	c-
1	96	90	68	44
2	92	74	60	24
3	67	50	51	19
4	108	92	72	41
5	75	61	55	29
6	92	86	56	36

missing addend and Task 5: Comparison, proved to be much more difficult than the others, a comparison was also made between the averages for the two addition problems and the averages for the two easier subtraction problems. Either way, Table 14 demonstrates the relative difficulties.

Similarity of Response Patterns for the Two Addition Tasks

An earlier pilot study (Carpenter, Hiebert and Moser, Note 6) used the same two addition tasks and found almost no difference in the responses given by children to those tasks. The results from the first interview reflect this same consistency of response. It would appear that children of the age represented by this sample do not differentiate between an action-oriented Joining addition problem and a static Part-Part-Whole addition problem. Table 15 presents the contrasts between the two problems on a level-by-level basis.

Subtraction Strategies and Problem Structure

Unlike the monolithic characterization of addition in the previous section, subtraction is not amenable to a single simple interpretation. A number of writers (e.g., Gibb, 1956) have suggested three interpretations, or structures, underlying subtraction. They are the subtractive, the additive, and the comparative. The four problem tasks were chosen with this categorization in mind. Task 2, Separating, reflects the subtractive notion in that its semantic structure strongly suggests the use of the separating or take-away strategy. Task 6, Joining, missing addend, reflects the additive notion in that its semantic structure suggests the additive strategy of adding-on or making a smaller set larger. Task 5, Comparison, reflects the static notion of comparison by suggesting neither adding on

Table 14

Average Number of Correct Responses for

Addition and Subtraction Problems by Level

	Level			
Type	b+	b-	c+	c-
Tasks 1, 4 (Addition)	102	91	70	42.5
Tasks 2, 3, 5, 6 (Subtraction)	81.5	67.75	55.5	27
Tasks 2, 6 (Easier Subtraction)	92	80	58	30

Table 15

Number of Responses on Two Verbal Addition Problems

		Model			Correct	Strategy				
		C	F	N	Y	CA	CS	CL	#F	HU
b+	Joining	66	15	63	96	70	13	9	14	0
	Part-Part-Whole	85	13	46	108	84	7	8	8	4
b-	Joining	0	66	52	90	60	11	8	10	8
	Part-Part-Whole	0	68	50	92	62	8	13	11	5
c+	Joining	77	6	18	68	67	5	11	1	3
	Part-Part-Whole	77	6	16	72	74	4	5	2	2
c-	Joining	0	60	25	44	29	11	12	0	2
	Part-Part-Whole	0	56	19	41	25	12	11	1	1

nor taking away, but rather a matching or contrasting of two sets. Task 3, Part-Part-Whole, missing addend, is the least suggestive of the four subtraction tasks since its semantic structure does not clearly indicate what strategy is most appropriate.

Pupils' choice of strategy for the four subtraction problems gives very strong evidence that problem structure was a major determining factor in that choice. For purposes of discussion, the Separating From (F), Separating To(T), Counting Down From (DF) and Counting Down To (DT) strategies will be aggregated into a single subtractive category. Similarly, the Adding On (AO) and Counting Up from Given (UG) strategies will be aggregated into a single additive strategy. And finally, Matching (MA) is essentially the comparative strategy. Table 16 presents the frequency of these combined strategy categories for each of the four subtraction problem types across the four levels.

For Separating and Joining, missing addend, the correspondence between problem structure and strategy used is obviously very strong. While the use of the comparative (Matching) strategy with the Comparison problem is not as predominant, the argument for the influence of problem structure on strategy choice is still supported in that the Matching strategy essentially appeared nowhere but in the Comparison problem. For those children who had the Matching strategy within their repertoire of problem-solving processes, the semantic structure of the Comparison problem was strong enough to evoke that strategy. Matching is virtually impossible without manipulatives, which accounts for the virtual absence of Matching at the b- and c- levels.

Although the separating strategies were the most popular ones for the Part-Part-Whole, missing addend problem, the proportion of their use compared to the additive strategies is not nearly so overpowering as

Table 16

Number of Responses for Different Subtraction

Strategies by Problem and Level

		Strategies		
Level	Problem Type	Subtractive	Additive	Comparative
b+	Separating	78	6	0
	Joining, missing addend	6	75	2
	Comparison	24	19	18
	Part-Part-Whole, missing addend	44	17	1
b-	Separating	63	4	0
	Joining, missing addend	1	81	0
	Comparison	12	33	2
	Part-Part-Whole, missing addend	35	11	0
c+	Separating	84	1	0
	Joining, missing addend	7	58	5
	Comparison	20	15	26
	Part-Part-Whole, missing addend	57	10	0
c-	Separating	41	1	1
	Joining, missing addend	0	36	0
	Comparison	5	23	0
	Part-Part-Whole, missing addend	19	15	0

in the case with the separating problem. This reflects the somewhat ambiguous semantic structure of the Part-Part-Whole, missing addend problem.

Less Frequently Occurring Strategies

During this first interview a number of the possible student response behaviors were observed infrequently. The two counting down strategies, Counting Down From and Counting Down To, appeared rather infrequently, especially in the larger-number conditions. Apparently, backward counting skills are not highly developed in beginning first-graders. Another set of relatively rare behaviors was the use of number facts and heuristics. Use of facts hardly ever occurred with the larger-number problems and only in isolated cases with subtraction problems. Facts were used most frequently in addition problems with smaller numbers and most often in connection with the simplest items such as 2 + 3 = 5 and 2 + 5 = 7.

Errors

No task was free of error, although the greater difficulty of the Comparison (Task 5) and the Part-Part-Whole, missing addend problems (Task 3) is reflected in the higher incidence of errors. The children's lack of comprehension of the structure of these two problems appears to be the cause for the large number of cases in which one of the given numbers was supplied as the answer. Overall, miscounting was the most frequent error. This occurred whether the children used cubes or their fingers or just counted mentally. A summary of the frequency of errors is presented in Table 17.

Secondary Analyses of Data

The data analyses contained in this section concern pupil performance rather than results for specific tasks as in the previous section. The patterns apparent in an individual student's response will be considered. In the first two subsections the relationship between a particular type of strategy or model employed and the correctness of response is examined.

In the third section we will examine the consistency of a particular strategy across several tasks.

Relationship of Strategy Employed to Correctness of Response

The basic question of interest in this analysis is, "If a child employed a particular strategy, was the problem also solved correctly?" Data answering this question are presented in Tables 18 to 21, which aggregate information by levels b+, b-, c+, and c- respectively.

The results for the following behaviors do not appear in the tables because they are inappropriate to our discussion.

1. Number Fact. A requisite for coding Number Fact is that the child's response must be correct. There were 45 responses coded as Number Fact in b+, 48 in b-, 7 in c+, and 4 in c-.

2. ? or confusion. A requisite for this coding is that the child gives no answer; therefore it could not be coded right or wrong. There were 4 such responses in level b+, 11 in b-, 4 in c+, and 22 in c-.

3. Uncodable. No strategy could be identified, even when the answer was correct. Of the 190 uncodable responses in level b+, 31% were correct; of the 128 uncodable responses in level b-, 35% were correct; of the 75 uncodable responses in level c+, 23% were correct; of the 112 uncodable responses in level c-, 23% were correct.

4. Wrong Operation. If the children used the wrong operation (for example, adding instead of subtracting), the answer was always incorrect. There were 12 responses in level b+ that were coded wrong operation, 8 in b-, 6 in c+, and 4 in c-.

Table 17

Frequency of Errors Across the Six Problem Tasks

		Error Types					
Task	Level	Miscount	Forgets data	Use Wrong operation	Given #	Guess	Interview terminated
1 Joining	b+	12	5	0	6	6	0
	b-	11	6	0	2	3	26
	c+	19	0	0	1	1	44
	c-	7	0	1	3	9	54
2 Separating	b+	10	3	4	4	7	0
	b-	10	0	2	5	1	26
	c+	25	0	1	1	2	44
	c-	20	1	0	3	11	54
3 Part-Part-Whole, missing addend	b+	11	1	3	18	8	0
	b-	9	2	3	17	5	26
	c+	18	1	0	2	5	44
	c-	18	2	0	5	14	54
4 Part-Part-Whole	b+	9	6	0	2	2	0
	b-	7	6	0	1	4	26
	c+	14	1	0	0	1	44
	c-	10	3	1	5	5	68
5 Comparison	b+	5	1	5	26	2	11
	b-	4	0	2	19	5	33
	c+	11	3	3	12	6	47
	c-	6	0	2	5	5	83
6 Joining, missing addend	b+	8	2	0	11	3	16
	b-	7	3	1	4	2	33
	c+	18	3	2	5	5	47
	c-	6	0	0	2	1	89

Table 18

Level b+: Number of Children Employing a Strategy and Their Rate of Success

	Task						
Strategy	1	2	3	4	5	6	Total
CS	13(92%)[a]	-	-	7 (100%)	-	-	20(95%)
CL	9 (100%)	-	-	8 (100%)	-	-	17(100%)
CA	70(79%)	-	-	84(86%)	-	-	154(82%)
F	-	72(89%)	41(73%)	-	21(90%)	6(67%)	140(84%)
T	-	0	1 (100%)	-	2 (100%)	0	3 (100%)
MA	-	0	1 (100%)	-	18(89%)	2 (50%)	21(86%)
AO	-	3 (100%)	10(100%)	-	10(90%)	60(92%)	83(93%)
DF	-	6 (33%)	1 (100%)	-	1 (100%)	0	8 (50%)
UG	-	3 (100%)	7 (100%)	-	9 (89%)	15(93%)	34(94%)
DT	-	0	1 (100%)	-	0	0	1 (100%)
HU	0	1 (100%)	2 (0%)	4 (100%)	1 (100%)	2 (50%)	10(70%)
GU	6 (17%)	7 (0%)	8 (13%)	2 (50%)	2 (0%)	3 (33%)	28(14%)

[a]Numbers in parentheses give the percentage of the children in that cell who solved the problem task correctly.

Table 19

Level b-: Number of Children Employing a Strategy and Their Rate of Success

	Task						
Strategy	1	2	3	4	5	6	Total
CS	11(91%)[a]	-	-	8 (100%)	-	-	19(95%)
CL	8 (88%)	-	-	13(100%)	-	-	21(95%)
CA	60(77%)	-	-	62(82%)	-	-	122(80%)
F	-	53(79%)	32(75%)	-	10(90%)	0	95(79%)
T	-	0	1 (100%)	-	1 (100%)	0	2 (100%)
MA	-	0	0	-	2 (100%)	0	2 (100%)
AO	-	1 (100%)	6 (67%)	-	16(81%)	53(91%)	76(87%)
DF	-	7 (100%)	1 (100%)	-	0	0	8 (100%)
UG	-	3 (100%)	5 (80%)	-	17(94%)	28(86%)	53(89%)
DT	-	3 (100%)	1 (100%)	-	1 (100%)	1 (100%)	6 (100%)
HU	8 (88%)	5 (80%)	4 (75%)	5 (60%)	2 (50%)	2 (0%)	26(69%)
GU	3 (0%)	1 (0%)	5 (0%)	4 (0%)	5 (40%)	2 (50%)	20(15%)

[a]Numbers in parentheses give the percentage of the children in that cell who solved the problem task correctly.

Table 20

Level c+: Number of Children Employing a Strategy and Their Rate of Success

	Task						
Strategy	1	2	3	4	5	6	Total
CS	5 (60%)[a]	-	-	4 (100%)	-	-	9 (78%)
CL	11(73%)	-	-	5 (100%)	-	-	16(81%)
CA	67(76%)	-	-	74(76%)	-	-	141(76%)
F	-	81(68%)	55(75%)	-	18(72%)	7 (71%)	161(71%)
T	-	0	0	-	1 (100%)	0	1 (100%)
MA	-	0	0	-	26(69%)	5 (60%)	31(68%)
AO	-	1 (0%)	7 (71%)	-	6 (67%)	45(78%)	59(75%)
DF	-	2 (50%)	2 (50%)	-	0	0	4 (50%)
UG	-	0	3 (33%)	-	9 (89%)	13(46%)	25(60%)
DT	-	1 (100%)	0	-	1 (100%)	0	2 (100%)
HU	3 (67%)	1 (100%)	3 (67%)	2 (100%)	1 (100%)	2 (100%)	12(83%
GU	1 (0%)	2 (0%)	5 (0%)	1 (0%)	6 (33%)	5 (20%)	20(15%)

[a]Numbers in parentheses give the percentage of the children in that cell who solved the problem task correctly.

Table 21

Level c-: Number of Children Employing a Strategy

and Their Rate of Success

	Task						
Strategy	1	2	3	4	5	6	Total
CS	11(82%)[a]	-	-	12(75%)	-	-	23(78%)
CL	12(92%)	-	-	11(91%)	-	-	23(91%)
CA	29(66%)	-	-	25(60%)	-	-	54(63%)
F	-	33(33%)	19(21%)	-	2 (50%)	0	54(30%)
T	-	0	0	-	1 (100%)	0	1 (100%)
MA	-	1 (0%)	0	-	0	0	1 (0%)
AO	-	0	4 (25%)	-	5 (80%)	10(70%)	19(63%)
DF	-	6 (33%)	0	-	1 (100%)	0	7 (43%)
UG	-	1 (100%)	11(64%)	-	18(78%)	26(88%)	56(80%)
DT	-	2 (50%)	0	-	1 (100%)	0	3 (67%)
HU	2 (100%)	1 (100%)	2 (50%)	1 (100%)	3 (33%)	2 (100%)	11(73%
GU	9 (0%)	11(9%)	14(14%)	5 (20%)	5 (20%)	1 (0%)	45(11%)

[a]Numbers in parentheses give the percentage of the children in that cell who solved the problem task correctly

5. Given Number. If a child responded with a number given in the problem, it was always in incorrect answer. There were 67 such responses in level b+, 48 in b-, 21 in c+, and 23 in c-.

The entries in Tables 18-21 present the number of children who used a certain strategy for a certain task. That number is followed by a percentage figure in parentheses, which represents the portion of those children using the strategy who also got the correct answer.

For example, in the example below, of the 13 children who used the counting up from smaller strategy for Task 1, 92% (which is to say, 12 of them) also solved the task correctly.

	Task	
Strategy	1	2
CS	13(92%)	-

In the example, a dash appears on the CS cell for Task 2. A dash indicates the strategy would be inappropriate for this task. In the example, CS is an addition strategy and thus was not coded for Task 2, a subtraction problem.

In addition Tasks 1 and 4, Counting Up from Larger strategy appears to be the most successful. This may reflect the fact that the more skilled children, who would be successful anyway, are the ones who opt to use the more sophisticated strategies. On the other hand, no single subtraction strategy stands out as more related to successful performance than any other.

Relationship of Model Used to Correctness of Response

We also investigated the relationship between a particular modeling behavior and the rate of correct responses. Tables 22-25 present the results. In the Model category the possible responses were cubes, fingers, no action, other (physical), or a combination of cubes and fingers. Uncodable model responses, confused responses, and combination of models other than cubes and fingers were not considered in the tabulation of these results.

The tables present the number of children who used a particular model for each task and the percentage of those children whose answer to the task was correct.

In general, the children appear to have performed more accurately with fingers than with cubes when the number domain was less than ten (levels b+ and b-), but did better with cubes than with fingers when the numbers were greater than ten (c+ and c-).

Consistency of Student Response

We also investigated whether a child who exhibited a particular response on a problem task would tend to exhibit that behavior on another task. More specifically, does a child show a consistent pattern of response, exhibiting the same behavior every time it is appropriate? Such consistency of behavior could indicate a child's interpretation of the operation of addition or subtraction. If, in a given level, a child used an additive strategy consistently over all four subtraction tasks, such consistency could indicate that the child has formed an interpretation of subtraction that is independent of the structure of a problem.

Consistency is examined in two ways. In the first, behavior was summarized across all the tasks administered within a specific level. In the second analysis, consistency was considered for a single task across all the levels in which it appeared. The total population of 144 subjects was used

Table 22

Level b+: Number of Children Employing a Model and Their Rate of Success

	Task						
Model	1	2	3	4	5	6	Total
Cubes alone	66(77%)[a]	83(73%)	77(51%)	85(79%)	74(58%)	70(76%)	455(69%)
Fingers alone	15(73%)	9(67%)	10(80%)	13(100%)	10(80%)	10(90%)	67(82%)
Cubes and Fingers	0	0	0	0	0	3(100%)	3(100%)
No action	63(54%)	52(48%)	56(36%)	46(61%)	47(51%)	44(61%)	308(51%)
Other	0	0	0	0	0	0	0

[a]Numbers in parentheses give the percentage of the children in that cell who solved the problem task correctly.

Table 23

Level b-: Number of Children Employing a Model and Their Rate of Success

	Task						
Model	1	2	3	4	5	6	Total
Cubes alone	NA	NA	NA	NA	NA	NA	NA
Fingers alone	66(80%)[a]	67(66%)	60(50%)	68(81%)	55(58%)	63(81%)	379(70%)
Cubes and Fingers	NA	NA	NA	NA	NA	NA	NA
No action	52(73%)	49(59%)	50(40%)	50(74%)	55(53%)	47(74%)	303(62%)
Other	0	1(100%)	0	0	0	0	1(100%)

[a]Numbers in parentheses give the percentage of the children in that cell who solved the problem task correctly.

Note: NA indicates the strategy is not applicable to this task.

Table 24

Level c+: Number of Children Employing a Model and Their Rate of Success

	Task						
Model	1	2	3	4	5	6	Total
Cubes alone	75(69%)[a]	84(65%)	73(62%)	77(74%)	68(62%)	75(63%)	452(66%)
Fingers alone	4(75%)	3(33%)	4(25%)	6(100%)	5(40%)	3(67%)	2[illegible](60%)
Cubes and Fingers	2(100%)	0	0	0	0	0	2(100%)
No action	18(61%)	13(31%)	23(22%)	16(56%)	22(50%)	19(37%)	111(42%)
Other	0	0	0	0	0	0	0

[a] Numbers in parentheses give the percentage of children in that cell who solved the problem task correctly.

Table 25

Level c-: Number of Children Employing a Model and Their Rate of Success

	Task						
Model	1	2	3	4	5	6	Total
Cubes alone	NA	NA	NA	NA	NA	NA	NA
Fingers alone	60(57%)[a]	49(27%)	49(16%)	56(54%)	28(54%)	35(71%)	277(45%)
Cubes and Fingers	NA	NA	NA	NA	NA	NA	NA
No action	24(42%)	35(31%)	33(27%)	19(58%)	31(45%)	20(55%)	162(41%)
Other	0	1(0%)	2(100%)	0	0	0	3(67%)

[a]Numbers in parentheses give the percentage of children in that cell who solved the problem task correctly.

Note: NA indicates the strategy is not applicable to this task.

in this analysis. In addition to considering use of model, correctness, and strategies, this analysis treated several combined strategies. The combined strategies represent similar patterns of thinking. The following combined strategies have been created for this analysis:

CE- The student responded either CL (Counts Up from Larger) or CS (Counts Up from Smaller).

SEP- The student responded either F (Separates From) or T (Separates To).

CTD- The student responded either DF (Counts Down From) or DT (Counts Down To).

SF- The student responded either F (Separates From) or DF (Counts Down From).

AD- The student responded either AO (Add On) or UG (Counts Up From Given).

ST- The student responded either T (Separates To) or DT (Counts Down To).

ADV- The student responded either with #F (Number Fact) or HU (Heuristic)

In general, the results show the following:

1. Within a level, once the children decide to use cubes or fingers as a model, they are fairly consistent in that use.

2. Overall, the children were not consistent in the use of strategies beyond a counts all in addition tasks. Some of this "inconsistency" may be the result of the high "drop-out" rate of the children - 144 did Task 1, Level b+, but only 55 finished through Task 6, Level c-.

There are, however, cases in which some children were consistent. These cases are detailed in Tables 26 and 27.

Table 26

Number of Children Who Gave Response

Maximum Number of Times Across Tasks by Level

Model or strategy	Maximum responses possible	b+	b-	c+	c-
Cubes	6	43	NA	52	NA
Fingers	6	-	30	-	15
No Action	6	19	24	10	8
Correct	6	26	20	13	3
CA	2	59	48	61	19
CE	2	8	10	7	14
F	4	3	-	-	-
SEP	4	3	-	-	-
SF	4	3	-	-	-

Note: NA indicates the strategy is not applicable to this task.

- (hyphen) indicates that the number of children who gave a response the maximum number of times was less than three.

Table 27

Number of Children Who Gave Response

Maximum Number of Times Across Levels by Task

Model or strategy	Maximum responses possible	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
No action	4	8	6	9	7	8	6
Correct	4	25	15	10	27	16	20
CA	4	14	NA	NA	14	NA	NA
F	4	-	19	7	-	-	-
SEP	4	NA	19	7	NA	-	-
SF	4	NA	25	9	NA	-	-
AO	4	NA	-	-	NA	-	4
AD	4	NA	-	-	NA	-	17

Note: NA indicates the strategy is not applicable to this task.

- (hyphen) indicates that the number of children who gave a response the maximum number of times was less than three.

Conclusion

This is the first in a series of reports on the data from the individual interviews for Coordinated Study #1. Each report contains data for only one round of interviewing, and is not concerned with results or changes across time. The longitudinal findings will be presented in separate reports. For subsequent reports in the individual interview series and for additional information and reports concerning Coordinated Study #1, contact the Mathematics Work Group at the Wisconsin Research and Development Center for Individualized Schooling, Madison, Wisconsin.

Reference Notes

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Romberg, T.A., Harvey, J.G., Moser, J.M. & Montgomery, M.E. Developing Mathematical Processes. Chicago: Rand McNally and Co., 1974.

APPENDIX A

PROBLEM TASKS BY LEVEL

Level b+

b+

1. Addition - simple joining

Wally had ___ pennies.

His father gave him ___ more pennies.

How many pennies did Wally have altogether?

b+

2. Subtraction - simple separating

Tim had ___ candies.

He gave ___ candies to Martha.

How many candies did Tim have left?

b+

3. Subtraction - part, part, whole missing addend

There are ___ children on the playground.

___ are boys and the rest are girls.

How many girls are on the playground?

b+

4. Addition - part, part, whole

Sara has ___ sugar donuts.

She also has ___ plain donuts.

How many donuts does Sara have altogether?

b+

5. Subtraction - difference

Joe has ___ balloons.

His sister Connie has ___ balloons.

How many more balloons does Connie have than Joe?

b+

6. Subtraction - simple joining missing addend

Kathy has ___ pencils.

How many more pencils does she have to put with them so she has ___ pencils altogether?

b-

1. Addition - simple joining

Fred had ___ stamps.

His mother gave him ___ more stamps.

How many stamps did Fred have altogether?

b-

2. Subtraction - simple separating

Joan had ___ apples.

She gave ___ apples to Louise.

How many apples did Joan have left?

b-

3. Subtraction - part, part, whole missing addend

There are ___ cookies on a plate.

___ are oatmeal and the rest are chocolate.

How many chocolate cookies are on the plate?

b-

4. Addition - part, part, whole

Judy has ___ white stuffed animals.

She also has ___ brown stuffed animals.

How many stuffed animals does Judy have altogether?

b-

5. Subtraction - difference

Mike has ___ kites.

His sister Kathy has ___ kites.

How many more kites does Kathy have than Mike?

b-

6. Subtraction - simple joining missing addend

Joe has ___ pet fish.

How many more fish does he have to put with them so he has ___ fish altogether?

Level C+

c+

1. Addition - simple joining

Sue had oranges.

Her mother gave her more oranges.

How many oranges did Sue have altogether?

c+

4. Addition - part, part, whole

Don saw tigers.

He also saw elephants.

How many animals did he see altogether?

c+

2. Subtraction - simple separating

Sally had rocks.

She gave rocks to Don.

How many rocks did Sally have left?

c+

5. Subtraction - difference

Jennifer has puzzles.

Her friend Ed has puzzles.

How many more puzzles does Ed have than Jennifer?

c+

3. Subtraction - part, part, whole missing addend

There are dogs in the park.

are big and the rest are little.

How many little dogs are in the park?

c+

6. Subtraction - simple joining missing addend

Susan has books.

How many more books does she have to put with them so she has books altogether?

C-

1. Addition - simple joining

Steve had ____ fish.

His friend gave him ____ more fish.

How many fish did Steve have altogether?

C-

2. Subtraction - simple separating

Diane had ____ marbles.

She gave ____ of them to Laura.

How many marbles did Diane have left?

C-

3. Subtraction - part, part, whole missing addend

There are ____ bikes in the yard.

____ are red and the rest are green.

How many green bikes are in the yard?

C-

4. Addition - part, part, whole

Jamie has ____ silver airplanes.

She also has ____ blue airplanes.

How many airplanes does Jamie have altogether?

C-

5. Subtraction - difference

Karl has ____ cards.

His friend Tony has ____ cards.

How many more cards does Tony have than Karl?

C-

6. Subtraction - simple joining missing addend

Mark has ____ candy bars.

How many more candy bars does he have to put with them so he has ____ candy bars altogether?

APPENDIX B

INDIVIDUAL STUDENT PROFILES

104	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CA	–	N	Y	UN	–	N	N	UN	–	N	Y	CS	–	N	Y	CS	–	N	Y	UG	–
b–	N	Y	CA	–	N	N	UN	–	N	Y	UN	–	N	Y	CA	–	N	Y	UG	–	N	Y	DT	–
c+	C	Y	CA	–	C	Y	F	–	N	N	GU	–	C	Y	CA	–	N	N	GU	–	N	N	GU	–
c–	N	N	GU	–	N	N	GU	–	N	N	GI	GI												

105	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	GI	GI	F	Y	F	–	F	Y	F	–	F	Y	CA	–	N	Y	UG	–	F	N	F	M
b–	F	Y	CA	–	F	N	F	M	F	Y	AO	–	N	N	GU	–	N	N	UN	–	F	N	AO	M
c+	N	Y	UN	–	N	N	UN	–	N	N	UN	–	N	N	UN	–	N	N	UN	–	N	Y	UN	–
c–	N	Y	UN	–	N	Y	UN	–	N	Y	UN	–	N	Y	UN	–	N	N	UN	–	N	N	UN	–

106	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	GU	–	C	N	F	M	C	N	UN	–	C	N	CA	M	C	Y	AO	–	C	[illegible]	AO	–
b–	F	Y	CA	–	F	[illegible]	F	–	N	N	GI	GI	F	Y	CA	–	F	Y	AO	–	F	Y	AO	–
c+	C	N	CA	M	C	N	F	M	N	N	UN	–	C	Y	CA	–	C	N	GI	GI	C	N	GI	GI
c–	F	N	UN	–	F	N	UN	–	N	N	GU	–												

107	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	F	Y	AO	–	F	Y	AO	–	C	N	CA	M	F	Y	AO	–	C	Y	AO	–
b–	F	Y	CA	–	F	Y	F	–	F	N	OP	O	N	Y	#F	–	F	Y	F	–	F	N	OP	O
c+	C	N	CL	M	C	Y	F	–	C	N	UN	–	C	Y	CA	–	C	Y	CA	–	C	N	AO	M
c–	F	N	CA	M	F	N	UN	–	–	?	?	–												

INDIVIDUAL STUDENT PROFILES

108	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	N	GI	GI	C	Y	CA	-	C	N	GI	GI	C	N	UN	-
b-	F	Y	CA	-	F	Y	F	-	F	N	GI	GI	F	Y	CA	-	F	Y	UN	-	F	N	UN	-
c+	C	N	CA	M	C	N	F	M	C	N	F	M	C	N	CA	M	-	?	?	-	C	N	F	M
c-	F	N	UN	-	F	N	UN	-	F	N	GU	-												

109	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	-	N	Y	UN	-	N	N	OP	O	N	N	UN	-	N	N	UN	-				
b-																								
c+																								
c-																								

110	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	N	GU	-	C	Y	CA	-	C	Y	F	-	C	Y	AO	-
b-	F	Y	CA	-	F	N	F	M	F	N	UN	-	F	Y	CA	-	F	N	GU	-	F	N	UN	-
c+	C	N	GI	GI	C	N	F	M	C	N	UN	-	C	N	CA	M	C	Y	MA	-	C	Y	AO	-
c-	F	N	CS	M	F	Y	F	-	F	N	UG	F	F	N	UN	-	N	Y	DF	-	N	N	UG	M

111	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	-	F	N	UN	-	N	Y	DF	-	N	Y	HU	-	N	F	GI	GI	N	N	HU	-
b-	N	Y	HU	-	N	N	UN	-	N	N	HU	-	N	Y	HU	-	N	N	UN	-	N	Y	UF	-
c+	F	Y	CA	-	C	N	F	M	C	Y	F	-	C	N	CA	-	C	Y	UN	-	C	N	GU	-
c-	F	Y	CA	-	F	N	F	-	F	?	?	-	F	Y	CA	-	F	N	UG	M	F	Y	UC	-

112	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y CS –	N N UN –	C N F M	C N UN –	C Y F –	C Y AO –
b–	F N CA M	F N UN –	F N UN –	F Y CA –	F N UN –	F Y AO –
c+	C N UN –	C N F –	C N UN –	C N CA M	C N MA M	C Y AO –
c–	F N UN –	F Y F –	F N UN –	F N GI GI	F N GI GI	F N GI GI

113	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C Y F –	C Y F –	C Y CA –	C Y F –	C N F M
b–	N Y CA –	N Y UG –	– ? ? –	N Y CA –	N N UN –	N Y #F –
c+	C Y CA –	C Y F –	C N F M	C Y CA –	C Y P –	C Y F –
c–	– ? ? –	N N UN –	N N GI GI	N N UN –		

115	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N CU –	N N GU –	N N UN –	N Y UN –		
b–						
c+						
c–						

116	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	F N CA M	C Y F –	F N F M	C Y CA –	C Y F –	C Y AO –
b–	F Y CA –	F N F M	F Y F –	F Y CA –	F N UN –	F Y AO –
c+	C N UN –	C Y F –	C Y F –	C Y CA –	C Y F –	C N OP O
c–	N N GU –	N N GU –	N N GU –			

117	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	#F	–	N	Y	#F	–	N	Y	UN	–	N	Y	#F	–	N	Y	UN	–	N	Y	#F	–
b–	N	Y	#F	–	N	Y	UN	–	N	N	UN	–	N	Y	UN	–	N	N	UN	–	N	Y	#F	–
c+	N	Y	UN	–	C	Y	F	–	N	N	GU	–	N	N	GU	–	N	N	GU	–	N	Y	GU	–
c–	N	N	GU	–	N	N	GU	–	N	N	GU	–												

118	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CL	–	N	Y	UN	–	N	Y	UG	–	N	Y	CL	–	N	Y	UN	–	N	Y	UG	–
b–	N	Y	HU	–	N	Y	DT	–	N	Y	UG	–	N	Y	CL	–	N	Y	UG	–	N	Y	UG	–
c+	N	N	CL	M	N	Y	DT	–	N	Y	UG	–	N	Y	CS	–	N	Y	DT	–	N	Y	UG	–
c–	N	Y	CS	–	N	Y	DT	–	N	Y	UG	–	N	Y	CL	–	N	Y	UG	–	N	Y	UG	–

119	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	CA	M	C	Y	F	–	C	Y	F	–	C	Y	CA	–	–	?	?	–	C	N	GI	GI
b–	F	Y	CA	–	F	N	F	M	F	N	UN	–	F	Y	CA	–	–	?	?	–	F	N	GI	GI
c+	C	Y	CA	–	C	N	F	M	C	N	UN	–	C	Y	CA	–	–	?	?	–	C	N	GI	GI
c–	F	N	CA	M	F	N	F	M	F	N	GU	–	F	N	CA	–	–	?	?	–	F	Y	AO	–

120	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	N	GI	GI	C	Y	CA	–	C	Y	AO	–	C	Y	AO	–
b–	F	N	CA	M	F	N	UN	–	N	N	GI	GI	F	Y	CA	–	F	Y	F	–	F	Y	AO	–
c+	C	Y	CA	–	C	Y	F	–	C	N	F	M	C	Y	CA	–	C	Y	T	–	C	N	AO	M
c–	F	Y	UN	–	N	N	UN	–	N	N	GU	–	F	Y	UN	–	N	Y	#F	–	N	Y	#F	–

123	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C Y F –	C Y F –	C Y CA –	C Y F –	C Y AO –
b–	F N CA F	F N UN –	F Y F –	F N CA M	N N UG M	F Y AO –
c+	C Y CA –	C [illegible] F –	C N F M	C N CA M	C N MA F	C Y AO –
c–	F Y CS –	N N DF M	N N UN –	F N CS M	N Y UG –	F Y UG –

124	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C Y F –	C Y F –	C Y CL –	C Y MA –	C Y AO –
b–	F Y CA –	F N F M	F Y F –	F Y CA –	N N UN –	F Y AO –
c+	C Y CA –	C N F M	C N UN –	C Y CA –		
c–						

127	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	F Y F –	C Y F –	C Y CA –	C Y MA –	C Y AO –
b–	F Y CA –	F Y F –	F Y F –	F Y CS –	F N UN –	F Y AO –
c+	C Y CA –	C Y F –	C Y F –	C N CA –	C N MA –	C Y AO –
c–	F Y CA –	F N F F	F Y F –	F Y CA –	N N UN –	F N AO M

128	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C Y F –	N N UN –	C Y CA –	C N GI GI	C N AO F
b–	F Y CA –	F N F M	F N GI GI	F Y CA –	F N GI GI	F Y AO –
c+	C Y CA –	C N F M	C N UN –	C Y CA –	C N GI GI	C N GI GI
c–	F N GI GI	F N F M	F N M	F Y CA –	F N GU –	F N UN –

129	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y CS -	C Y F -	N N UN -	C Y CA -	C Y MA -	C Y AO -
b-	F Y CA -	F N UN -	N N GU -	N Y CA -	F Y T -	F Y AO -
c+	C Y CA -	C Y F -	N N UN -	C Y CA -	C Y F -	C N AO F
c-	F N UN -	F N F M	N N GU -	F N UN -		

130	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y #F -	N N OP O	N N HU -	N Y HU -	N Y UN -	N Y UG -
b-	N N UN -	N N UN -	N N UN -	N N HU -	N Y UN -	N Y UG -
c+	N N HU -	N N UN -	N N UN -	N Y HU -	N Y HU -	N N UG M
c-	N Y HU -	N N UN -	N N UN -	N N UN -	N N GU -	N Y UN -

131	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA -	C Y AO -	C N UN -	C Y CA -	N Y UN -	C N GU -
b-	F Y CL -	F Y F -	F N UN -	F Y CA -	N N GU -	N N HU -
c+	C Y CA -	C Y F -	N N GU -	C Y CA -	N Y GU -	C N GU -
c-	F N GU -	N Y GU -	N N GU -	F N GU -		

132	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C N CA M	C Y F -	C Y F -	C Y CA -	C Y F -	C Y F -
b-	F Y CA -	F Y F -	F Y T -	F N CA M	F Y AO -	N Y UN -
c+	C Y CA -	C Y F -	C N F M	C Y CA -	C N F F	C Y AO -
c-	F N CA M	F N F M	F Y UG -	F Y CA -	F Y T -	N Y UG -

133	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C N GI GI	N N UN -	N N UN -	N N UN -	N N UN -	N N GI GI
b-						
c+						
c-						

134	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N GI GI	N N UN -	N N UN -	N N UN -		
b-						
c+						
c-						

135	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA -	C Y F -	C N UN -	C Y CA -	C N OP O	C N GI GI
b-	N Y UN -	N Y UN -	N N GI GI	N Y UN -	N N GI GI	N N GI GI
c+	C Y CA -	C Y F -	C N UN -	C Y CA -	C N OP O	C Y AO -
c-	N N UN -	N N GI GI	N N UN -			

136	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N GI GI	N N UN -	N N GI GI	N N UN M	N N GI GI	N N UN -
b-						
c+						
c-						

139	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C N GI GI	C Y UN –	C Y CA –	C N GI GI	C Y #F –
b–	N N GU –	N N UN –	N N GI GI	N N GU –		
c+	C Y CA –	C N F M	N N GU –	C Y CA –	N N GU –	C N UN –
c–						

140	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N UN –	N Y UN –	N N GI GI	N Y UN –	N Y UN –	N Y UN –
b–	F Y CA –	F N GI GI	N Y UN –	N Y UN –		
c+						
c–						

141	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C N UN –	C N UN –	C N OP O	C N UN –	C N OP O	
b–						
c+						
c–						

142	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C N UN –	N N GI GI	C N UN –	C N UN –	C N UN –
b–						
c+						
c–						

143	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
b-	F	Y	CS	–	F	Y	F	–	F	Y	F	–	F	Y	CS	–	F	Y	UN	–	N	Y	UN	–
c+	C	N	CA	M	C	N	OP	M	C	N	F	M	F	Y	UN	–	C	Y	MA	–	C	Y	AO	–
c-	N	Y	UN	–	O	N	F	M	O	Y	F	–	F	Y	CS	–	F	Y	AO	–	F	Y	AO	–

144	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	UN	–	C	N	UN	–	C	N	UN	–	C	Y	CA	–	C	N	GI	GI	C	Y	AO	–
b-	N	N	GU	–	N	N	GU	–	N	N	GU	–	N	N	GU	–								
c+	C	Y	CA	–	C	N	F	M	C	N	UN	–	C	N	CA	M	N	N	GI	GI	C	N	UN	–
c-																								

145	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CA	–	C	N	GU	–	C	N	UN	–	C	N	CA	F	C	N	UN	–	C	N	GI	GI
b-	F	N	CA	F	N	N	GI	I	F	N	UN	–	F	N	CA	F	F	N	UN	–	F	N	GI	GI
c+																								
c-																								

149	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	[illegible]	CA	F	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	N	AO	M	C	Y	AO	–
b-	F	N	CA	M	F	Y	F	–	F	Y	F	–	F	Y	CA	–	F	Y	F	–	F	Y	AO	–
c+	C	Y	CA	–	[illegible]	Y	F	–	C	N	F	M	C	Y	[illegible]	–	C	N	AO	M	C	Y	AO	–
c-	F	Y	CS	[illegible]	[illegible]	N	DF	M	F	N	F	M	F	Y	CS	–	F	Y	AO	–	F	Y	AO	–

150	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	–	C	N	GI	GI	C	N	GI	GI	N	N	UN	–								
b–																								
c+																								
c–																								

151	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	–	N	N	UN	–	N	N	UN	–	N	N	UN	–								
b–																								
c+																								
c–																								

153	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	UN	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	N	GI	GI	C	Y	AO	–
b–	F	Y	CA	–	F	Y	F	–	–	?	?	–	F	Y	CA	–	N	N	GI	GI	–	?	?	–
c+	C	N	CA	M	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	N	MA	F	C	Y	AO	–
c–	–	?	?	–	–	?	?	–	–	?	?	–												

154	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	Y	CL	–	F	Y	UN	–	N	N	UN	–	F	Y	CA	–	C	N	UN	–	C	N	GI	GI
b–	F	Y	CS	–	F	Y	F	–	F	N	UN	–	F	Y	CS	–	F	N	UN	–	F	Y	AO	–
c+	C	Y	CS	–	C	Y	F	–	N	N	UN	–	F	Y	CL	–	N	N	GI	GI	F	Y	UG	–
c–	F	N	OP	O	N	N	UN	–	N	N	GI	GI	F	Y	CL	–	N	N	UN	–	F	Y	UG	–

155	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	N	F	F	C	N	F	M	C	Y	CA	–	C	Y	F	–	C	Y	F	–
b–	N	Y	CA	–	N	Y	DF	–	N	Y	UN	–	N	Y	CL	–	N	Y	#F	–	N	Y	UN	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
c–	F	Y	CS	–	N	Y	DF	–	N	N	UN	–	F	Y	CA	–	N	Y	UG	-	F	Y	UG	–

157	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	–	N	N	GU	–	N	N	GI	GI	N	N	GI	GI	N	N	GI	GI	N	N	GI	GI
b–																								
c+																								
c–																								

158	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	N	GI	GI	C	N	CA	M	C	Y	F	–	C	Y	AO	–
b–	F	Y	UN	–	F	N	GI	GI	N	N	GI	GI	F	N	UN	–	N	N	GI	GI	F	Y	AO	–
c+	C	N	CS	M	C	Y	UN	–	C	N	F	M	C	Y	CA	–	C	N	F	M	C	N	UN	–
c–																								

159	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	CA	M	N	N	UN	–	N	N	GI	GI	N	Y	CA	–	N	N	UN	–	N	N	UN	–
b–																								
c+																								
c–																								

160	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CL	–	C	Y	F	–	N	Y	#F	–	C	Y	CA	–	N	N	OP	O	N	Y	#F	–
b–	N	Y	UN	–	N	Y	UN	–	N	Y	UN	–	N	Y	#F	–	N	N	UN	–	N	Y	#F	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	N	N	UN	–	C	N	GI	GI	C	N	AO	M
c–																								

161	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CL	–	N	N	UN	–	C	N	UN	–	N	Y	UN	–	N	N	GI	GI	N	Y	#F	–
b–	F	N	GU	–	N	Y	#F	–	N	N	UN	–	N	Y	UN	–	N	N	GI	GI	F	Y	AO	–
c+																								
c–																								

162	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	–	N	Y	#F	–	N	Y	GU	–	N	N	UN	–	N	Y	#F	–	N	N	UN	M
b–	N	Y	UN	–	N	N	HU	–	N	N	GU	–	F	Y	CA	–	F	N	UN	–	N	N	HU	–
c+																								
c–																								

163	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	N	Y	UN	–	C	Y	CA	–	C	Y	F	–	C	N	UG	M
b–	N	Y	CL	–	N	N	UN	–	N	N	UN	–	N	Y	CL	–	N	Y	UG	–	N	Y	UG	–
c+	C	Y	CL	–	C	N	F	M	C	Y	F	–	C	N	UN	–	C	Y	AO		C	Y	AO	–
c–	F	Y	CL	–	F	N	UN	–	F	N	UN	–	F	Y	CI	–	N	Y	UN	–	F	Y	UC	–

165	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	GU	-	C	Y	F	-	N	N	UN	-	C	N	UN	-	-	?	?	-	N	Y	UN	-
b-	N	N	UN	-	N	N	UN	-	N	N	OP	O	N	N	UN	-								
c+																								
c-																								

166	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	AF	-	F	N	DF	M	C	N	F	M	C	N	UN	-	C	N	UN	-	C	Y	AO	-
b-	F	Y	CL	-	F	Y	F	-	F	N	F	M	F	Y	CS	-	N	Y	UG	-	F	Y	AO	-
c+	C	N	CA	M	C	N	F	M	C	Y	F	-	C	Y	CA	-	C	Y	F	-	C	N	AO	M
c-	F	N	CA	M	F	N	F	M	F	N	F	M	F	N	CA	M	F	Y	F	-	F	N	UN	-

167	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	Y	AO	-	C	Y	CA	-	C	Y	F	-	N	Y	UN	-
b-	N	Y	CA	-	N	N	UN	-	N	N	UG	M	N	Y	CA	-	N	Y	UN	-	N	N	UG	F
c+	C	Y	CA	-	C	N	F	M	C	Y	F	-	C	N	CA	M	C	Y	F	-	C	N	MA	F
c-	N	N	UN	-	N	Y	UN	-	N	N	GI	GI	N	Y	UN	-	N	N	UN	-	N	N	UN	-

168	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CL	-	N	N	OP	O	N	Y	DT	-	N	Y	UN	-	N	N	GI	G	N	N	UN	-
b-	N	Y	CS	-	N	Y	UG	-	N	N	UN	-	N	Y	UN	-	N	Y	UN	-	N	N	UG	M
c+	N	N	UN	-	N	N	UN	-	N	N	UG	M	N	N	CA	F	N	N	OP	O	N	Y	UG	-
c-	N	Y	CL	-	N	N	DT	M	N	N	UG	M	N	Y	CA	-	N	N	OP	O	N	Y	UG	-

169	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	UN	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	N	GI	GI	C	Y	AO	–
b-	F	Y	CA	–	F	Y	F	–	–	?	?	–	F	Y	CA	–	N	N	GI	GI	F	Y	AO	–
c+	C	Y	CA	–	C	N	F	M	C	Y	F	–	C	Y	CA	–	C	N	GI	GI	C	N	AO	M
c-	F	Y	CA	–	–	?	?	–	F	N	UN	–	F	N	GI	GI	N	N	GI	GI	F	N	UN	–

171	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	CA	M	C	Y	F	–	C	N	GI	GI	C	Y	CA	–	C	Y	F	–	C	Y	AO	–
b-	F	N	CA	M	F	Y	F	–	F	N	AO	M	F	N	CA	M	F	N	AO	M	F	Y	AO	–
c+	C	Y	CA	–	C	N	F	M	C	N	F	M	C	N	CA	M	C	N	MA	M	C	N	AO	M
c-	F	Y	CA	–	F	N	F	M	F	N	F	M	F	N	CA	M	N	Y	UG	–	N	Y	UG	–

172	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	UN	–	C	Y	F	–	C	Y	AO	–
b-	F	N	CA	M	F	Y	F	–	F	Y	F	–	F	Y	CA	–	F	Y	UG	–	F	Y	AO	–
c+	C	N	CA	M	C	Y	F	–	C	Y	AO	–	C	N	CA	M	C	Y	AO	–	C	N	AO	M
c-	F	Y	CS	–	N	N	GU	–	F	Y	UG	–	F	Y	CL	–	F	Y	UG	–	F	Y	UG	–

173	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	N	F	M	C	Y	CA	–	C	N	GI	GI	C	Y	AO	–
b-	N	Y	HU	–	N	Y	#F	–	F	N	GI	GI	N	Y	#F	–	F	Y	UN	–	F	Y	AO	–
c+	C	Y	CL	–	C	N	F	M	C	Y	F	–	C	Y	CA	–	C	Y	MA	–	C	Y	F	–
c-	F	Y	CS	–	F	N	F	–	–	?	?	–	N	Y	CL	–	F	N	UG	M	F	Y	UG	–

175	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA -	C Y F -	C N UN -	C Y CA -	C Y UN -	C Y F -
b-	F Y CA -	F Y F -	F N UN -	F N GI GI	F Y AO -	F Y AO -
c+	C N CA M	C Y F -	C N F M	C N CA M	C Y UG -	C N AO M
c-						

176	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	F Y CA -	C Y F -	C Y F -	C Y CA -	C Y F -	C Y AO -
b-	F Y CA -	F Y F -	F Y F -	F Y CA -	F Y AO -	F Y AO -
c+	C Y CA -	C Y F -	C Y F -	C Y CA -	C Y F -	C N AO M
c-	F Y CA -	F Y [illegible] -	F Y F -	F Y CA -	F N HU -	F N UN -

177	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA -	C N UN -	C N GI GI	C Y CA -	C Y T -	C Y AO -
b-	N N CA M	N Y UG -	- ? ? -	F Y CA -	F Y F -	F Y AO -
c+	C N CA M	C N F M	C N F M	C Y CA -	C Y MA -	C Y AO -
c-	F ? ? -	F N F -	F N F -	F N UN -	F ? ? -	

203	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y CL -	N Y UG -	N Y UG -	N Y CL -	F Y UN -	F Y UG -
b-	N Y HU -	F Y HU -	F Y HU -	N Y #F -	F Y #F -	F Y UG -
c+	N Y CL -	C N F -	C Y F -	F Y CL -	C Y MA -	C Y AO -
c-	N Y CL -	F N F -	F N F -	F Y CA -	F N UN -	F N UN -

205	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	–	N	Y	UG	–	N	Y	UG	–	C	Y	CS	–	N	N	GI	GI	N	Y	UG	–
b–	N	N	HU	F	N	Y	#F	–	N	Y	UN	–	N	N	UN	–	N	N	GI	GI	N	N	UN	–
c+																								
c–																								

206	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	Y	CA	–	N	N	UN	F	C	N	GI	GI	N	N	CA	F	N	N	GI	GI	N	N	UN	–
b–																								
c+																								
c–																								

207	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CS	–	C	Y	HU	–	F	Y	F	–	F	Y	CA	–	N	Y	UN	–	F	Y	AO	–
b–	F	Y	CA	–	F	Y	F	–	N	Y	F	–	F	Y	CA	–	N	Y	HU	–	F	Y	AO	–
c+	F	N	UN	–	F	N	DF	M	F	N	DF	–	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
c–	F	Y	CA	–	F	N	F	–	F	N	F	–	F	N	CS	F	F	Y	UG	–	F	Y	HU	–

208	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CL	–	C	Y	AO	–	C	Y	F	–	C	N	UN	–	C	N	GI	GI	C	Y	AO	–
b–	F	Y	CA	–	F	Y	F	–	F	Y	F	–	F	Y	CA	–	F	Y	GU	–	F	Y	AO	–
c+	C	N	CL	M	C	Y	F	–	F	Y	AO	–	C	Y	CS	–	C	Y	GU	–	C	Y	AO	–
c–	F	Y	CS	–	F	Y	F	–	F	Y	GU	–	F	Y	CS	–	N	Y	GU	–	F	Y	AO	–

210	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	Y	AO	-	C	Y	CA	-	C	N	UN	F	C	Y	AO	-
b-	F	Y	#F	-	F	Y	F	-	F	Y	F	-	F	Y	CA	-	F	Y	AO	-	N	Y	UG	-
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	Y	F	-	C	Y	MA	-
c-	F	Y	CA	-	F	Y	F	-	F	N	UN	-	F	Y	CS	-	N	Y	HU	-	F	Y	UN	-

211	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	CS	M	C	N	UN	-	C	N	UN	-	C	N	CA	F								
b-																								
c+																								
c-																								

213	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	GI	GI	C	N	GI	GI	N	N	GU	-	C	N	CA	F								
b-																								
c+																								
c-																								

215	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	-	N	N	UN	-	C	N	UN	-	C	Y	CA	-	N	N	UN	-				
b-																								
c+																								
c-																								

217	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	N	CA	F	N	N	GU	–	N	N	UN	–	N	Y	CA	–	N	N	GI	GI	N	N	UN	–
b–																								
c+																								
c–																								

218	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CS	–	C	Y	F	–	C	Y	AO	–	C	Y	CL	–	C	Y	#F	–	C	Y	AO	–
b–	N	Y	CS	–	O	Y	F	–	N	Y	UN	–	N	N	GU	–	N	Y	UG	–	N	Y	UG	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	F	Y	UG	–	C	Y	AO	–
c–	N	N	GU	–	N	Y	UN	–	O	Y	AO	–	N	Y	CA	–	N	N	UN	–	N	N	UN	–

220	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	N	F	M	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
b–	N	Y	CA	–	F	Y	F	–	N	Y	UG	–	N	Y	CS	–	N	Y	UG	–	N	Y	UG	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	N	UN	–	C	Y	MA	–	C	Y	AO	–
c–	F	Y	CA	–	F	Y	F	–	F	N	UN	–	F	Y	CA	–	F	Y	UN	–	F	N	UN	–

222	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	Y	CS	–	N	Y	#F	–	F	Y	F	–	F	Y	UN	–	C	N	MA	M	C	N	MA	M
b–	N	Y	UN	–	N	Y	#F	–	F	Y	F	–	F	Y	CL	–	F	Y	F	–	F	Y	AO	–
c+	N	Y	CL	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	N	MA	M	C	Y	AO	–
c–	F	Y	CL	–	F	N	F	–	F	N	AO	M	F	Y	CL	–	F	Y	AO	–	F	Y	AO	–

223	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CS	–	C	Y	F	–	C	N	F	M	C	Y	CL	–	C	Y	F	–	C	Y	AO	–
b–	F	Y	CA	–	F	Y	F	–	F	Y	F	–	F	Y	CA	–	N	Y	UG	–	F	N	UG	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	Y	F	–	C	Y	AO	–
c–	F	Y	CS	–	F	Y	DF	–	F	Y	UG	–	F	Y	CS	–	F	Y	UG	–	F	Y	UG	–

224	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	#F	–	N	Y	UG	–	N	Y	UG	–	N	Y	#F	–	N	Y	#F	–	N	Y	#F	–
b–	N	Y	#F	–	N	Y	HU	–	N	Y	#F	–	N	Y	HU	–	N	Y	#F	–	N	N	UN	F
c+	N	Y	HU	–	N	Y	HU	–	N	Y	HU	–	N	Y	#F	–	N	Y	UG	–	N	N	UG	M
c–	N	N	UN	–	N	Y	UN	–	N	Y	HU	–	N	Y	UN	–	N	Y	UN	–	N	Y	UG	–

225	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CS	–	N	N	UN	–	N	N	UN	–	N	N	UN	–	N	Y	UG	–	N	Y	UG	–
b–	N	Y	CL	–	N	N	UN	–	N	N	UN	–	N	Y	CL	–	N	N	GI	GI	N	Y	UG	–
c+																								
c–																								

226	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	–	N	Y	#F	–	N	N	OP	O	N	Y	HU	–	N	N	GI	GI	N	N	UN	–
b–	N	N	UN	–	N	Y	#F	–	N	N	UN	–	N	N	UN	–								
c+																								
c–																								

227	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N UN –	C N UN –	C N UN –	C N UN M	C N UN –	
b-						
c+						
c-						

229	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N UN –	N Y F –	N N UN –	N N UN –	N N UN –	N N GU –
b-						
c+						
c-						

230	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N UN –	N Y UN –	– ? ? –	C Y CA –	N Y UN –	N N UN –
b-	N Y UN –	– ? ? –	N N GU –	N N UN –	N N UN –	N N UN –
c+						
c-						

231	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C Y F –	C Y F –	C Y CA –	C N MA M	C Y AO –
b-	F Y CA –	F Y F –	F N GI GI	F Y CA –	F N OP O	F Y AO –
c+	C Y CA –	C Y F –	C N UN –	C Y CA –	C Y UN –	C Y AO –
c-	F Y CA –	F N UN M	N N UN –	F Y CA –	F N UN –	F Y UN –

235	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	Y	UN	–	C	Y	CA	–	C	Y	MA	–	C	Y	MA	–
b–	N	N	CA	M	N	N	F	M	N	N	F	M	N	N	CA	M								
c+																								
c–																								

236	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	Y	AO	–	C	Y	CA	–	N	N	GU	–	C	Y	AO	–
b–	F	Y	CS	–	N	Y	F	–	F	N	UN	F	F	Y	CA	–	F	Y	F	–	F	Y	AO	–
c+	C	Y	CA	–	C	N	F	M	C	Y	F	–	C	Y	CA	–	C	Y	F	–	C	Y	AO	–
c–	F	Y	CA	–	F	Y	F	–		N	F	M	F	Y	CA	–	F	N	F	M	F	Y	AO	–

237	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	#F	–	C	Y	F	–	C	Y	F	–	C	Y	#F	–	C	N	GI	GI	C	N	GI	GI
b–	N	Y	CA	–	F	Y	F	–	F	N	GI	GI	F	Y	CA	–	F	N	GI	GI	F	Y	AO	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	N	GI	GI	C	N	GI	GI
c–	F	N	GI	GI	F	N	F	M	F	N	UN	–	F	N	GI	GI								

238	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	–	N	Y	UN	–	N	N	UN	–	N	Y	UN	–	N	Y	#F	–	N	N	UN	–
b–	N	Y	UN	–	N	N	UN	–	N	N	GU	–	N	Y	#F	–	N	Y	#F	–	N	N	UN	–
c+	N	N	UN	–	N	N	UN	–	N	N	UN	–	N	N	UN	–	N	N	UN	–	N	N	UN	–
c–																								

239	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	F Y CA –	N N UN –	C N UN –	C Y CA –	C N GI GI	C Y AO –
b–	F N GI GI	F N OP O	– ? ? –	F Y CA –		
c+						
c–						

240	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	F Y CA –	N N GU –	N N GU –	F Y CA –	F Y AO –	N N AO F
b–	N Y HU –	N N UN –	F N GI GI	N Y #F –	N Y UG –	F Y AO –
c+	N Y UN –	N N UN –	N Y UN –	N Y #F –	N Y UG –	N N UN –
c–	N Y CL –	N Y UN –	N N UN –			

241	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N UN –	N Y UN –	N N UN –	N N CA M	N N GI GI	– ? ? –
b–						
c+						
c–						

242	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C Y F –	C Y [illegible] –	C Y CA –	C N UN –	C N AO M
b–	F Y CA –	F Y F –	F N F M	F N UN –	F N UN –	F Y AO –
c+						
c–						

244	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y CA -	N Y UN -	C Y AO -	C Y CA -	C N F M	N Y UN -
b-	N Y CA -	N Y UN -	- ? ? -	N N CA M	N N HU -	N Y UG -
c+						
c-						

246	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N GI GI	C N OP O	N N GI GI	N N CA M		
b-						
c+						
c-						

247	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y #F -	N Y DF -	N Y #F -	N Y HU -	N Y DF -	N N UN -
b-	N Y CL -	N Y DF -	N Y UN -	N Y CS -	N Y UN -	N Y UG -
c+	N N CS -	N Y DF -	N N UN -	N N UN -	N Y UG -	N N UG -
c-						

249	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	F N CA M	F Y F -	C N UN -	F Y CA -	C Y F -	F Y AO -
b-	F Y CA -	F N F M	F N GI GI	F N CA F	F Y AO -	F Y AO -
c+						
c-						

251	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	UN	-	C	Y	F	-	C	N	F	M	C	Y	CA	-	C	Y	F	-	C	Y	AO	-
b-	F	Y	CA	-	F	Y	F	-	F	Y	AO	-	F	Y	CA	-	F	N	AO	-	F	Y	AO	-
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	Y	MA	-	C	Y	AO	-
c-	N	N	UN	-	F	N	F	M	F	N	UN	-	F	N	GI	GI	F	N	AO	M				

252	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	GU	-	N	N	UN	-	N	N	GU	-	C	N	GI	GI	C	N	UN	-				
b-																								
c+																								
c-																								

253	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	-	N	N	GU	-	N	N	GU	-	N	N	UN	-								
b-																								
c+																								
c-																								

254	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	UN	F	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	N	UN	-	C	Y	AO	-
b-	N	N	UN	-	N	N	UN	-	N	N	UN	-	N	Y	CA	-	N	N	UN	-	N	N	UG	F
c+	N	N	UN	-	N	N	UN	-	N	N	UN	-	N	N	UN	-								
c-																								

256	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	UN	-	N	N	UN	-	N	N	UN	-	N	N	UN	-								
b-																								
c+																								
c-																								

257	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	CA	M	C	N	F	M	C	Y	F	-	C	N	CA	M	C	N	F	-	C	N	AO	M
b-	F	Y	CA	-	F	N	F	-	F	N	F	-	F	Y	CA	-	F	N	AO	-	F	Y	AO	-
c+	C	N	CA	M	C	Y	F	-	C	N	F	M	C	Y	CA	-	C	Y	MA	-	C	N	MA	M
c-	F	N	CA	-	F	N	F	M	F	N	F	M	N	N	GU	-								

258	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	#F	-	C	Y	F	-	C	Y	AO	-	C	Y	CA	-	C	Y	MA	-	C	Y	AO	-
b-	F	Y	CS	-	F	Y	F	-	F	N	GI	GI	F	Y	CA	-	N	Y	MA	-	F	Y	AO	-
c+	C	N	CA	M	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	Y	MA	-	C	Y	MA	-
c-	F	N	UN	-	F	Y	UN	-	-	?	?	-	F	Y	CS	-	-	?	?	-	F	N	GI	GI

260	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	Y	UN	-	C	Y	CA	-	C	Y	F	-	C	Y	AO	-
b-	F	Y	CA	-	F	Y	F	-	F	Y	F	-	F	Y	CA	-	F	Y	F	-	F	Y	AO	-
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	Y	MA	-	C	N	UN	M
c-	F	N	CA	M	F	Y	F	-	F	N	F	N	F	N	CA	M	F	Y	AO	-	F	N	AO	M

261	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
b–	F	Y	CA	–	F	Y	F	–	F	Y	F	–	F	Y	CA	–	F	N	F	M	F	Y	AO	–
c+	C	Y	CA	–	C	Y	F	–	C	N	GI	GI	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
c–	F	Y	CA	–	F	N	UN	–	F	N	UN	–	F	N	UN	–								

262	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	N	GU	–	C	N	CA	F	C	N	GI	GI	C	Y	AO	–
b–	F	N	GI	GI	F	Y	F	–	F	N	OP	O	F	Y	CA	–	N	N	GI	GI	F	N	AO	M
c+																								
c–																								

264	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CL	–	N	Y	UN	–	N	N	GI	GI	N	Y	CL	–	F	Y	AO	–	F	Y	UN	–
b–	F	Y	CS	–	N	Y	#F	–	–	?	?	–	F	Y	CL	–	F	Y	AO	–	F	[illegible]	UN	–
c+	C	Y	CA	–	C	N	UN	–	C	Y	F	–	C	Y	CA	–	C	Y	F	–	C	Y	AO	–
c–	F	Y	CA	–	F	N	UN	–	F	N	F	M	F	N	CA	M								

266	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	CA	M	N	N	DF	M	N	N	GI	GI	N	Y	CA	–	N	N	UN	–	N	N	GI	GI
b–																								
c+																								
c–																								

267	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	#F	-	N	N	UN	-	F	Y	F	-	N	Y	CS	-	F	Y	HU	-	N	Y	UG	-
b-	N	Y	#F	-	N	Y	DF	-	F	Y	F	-	F	Y	CA	-	N	Y	UG	-	N	Y	UG	-
c+	N	Y	HU	-	C	Y	F	-	N	Y	DF	-	N	Y	UN	-	N	Y	UN	-	C	Y	AO	-
c-	N	Y	HU	-	N	N	UN	-	N	Y	UG	-	F	Y	CA	-	N	N	UG	M	F	Y	AO	-

268	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	N	CA	M	C	N	F	M	F	Y	F	-	F	Y	CA	-	F	Y	AO	-	F	Y	AO	-
b-	F	Y	CS	-	F	N	F	M	F	N	F	M	F	Y	CA	-	F	Y	AO	-	F	Y	AO	-
c+	C	N	UN	-	C	Y	F	-	C	Y	F	-	C	N	CA	M	C	N	UN	-	C	N	F	M
c-	F	N	CA	M	F	N	F	M	F	N	F	F	F	N	CA	F								

269	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	#F	-	N	Y	#F	-	N	Y	#F	-	N	Y	#F	-	N	N	UN	-	N	Y	HU	-
b-	N	Y	HU	-	N	N	#F	-	N	Y	UN	-	N	Y	HU	-	N	Y	#F	-	N	Y	#F	-
c+	N	Y	#F	-	C	N	F	-	C	Y	F	-	N	Y	UN	-	C	N	MA	-	C	Y	MA	-
c-	F	Y	CL	-	N	N	GU	-	-	?	?	-	N	Y	UN	-	N	Y	UG	-	F	Y	UG	-

270	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	Y	UN	-	C	Y	F	-	C	N	UN	-	C	Y	CA	-	C	Y	AO	-	C	Y	AO	-
b-	F	Y	CA	-	F	N	UN	-	F	Y	F	-	F	N	CA	F	F	N	UN	-	F	N	AO	M
c+																								
c-																								

271	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA -	C Y F -	C N UN -	C Y CA -	C N OP O	C Y F -
b-	F Y CA -	F N OP O	F N AO F	F Y CA -	F N OP O	F Y AO -
c+	C Y CA -	C N F M	C Y F -	C Y CA -	C N OP O	C N GI GI
c-	F Y CA -	F N UN -	F N UN -	F N CA M	F N OP O	

301	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	F Y CA -	N Y #F -	N Y UN -	F Y CS -	N Y UN -	N Y #F -
b-	N N UN -	N N UN -	F Y AO -	F Y CS -	N N GI GI	F Y AO -
c+	- ? ? -	N N GU -	N N UN -	- ? ? -	N N GU -	N N GU -
c-						

302	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C N CA F	C Y F -	N N GU -	C N UN F	N N GI GI	C Y AO -
b-	F N CA M	N N UN -	N N UN -	N N HU M	N N GI GI	N Y UG -
c+						
c-						

303	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C N CA F	C Y [illegible] -	N Y #F -	N Y #F -	C Y F -	C Y AO -
b-	F Y CA -	N Y #F -	N Y #F -	N Y #F -	N Y #F -	N Y #F -
c+	C Y CA -	N Y #F -	N Y HU -	F Y CA -	N Y #F -	F Y AO -
c-	N N GU -	F N F -	F N UN -	F Y UN -		

304	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	C Y CA –	C Y F –	C N UN –	C Y CA –	C N GI GI	C N GI GI
b–	F Y CA –	F Y F –	F Y F –	F Y CA –	F N GI GI	F Y AO –
c+	C N CA M	C Y F –	C N UN –	C Y CA –	N N GI GI	C N OP O
c–	F N C M	N N GU –	I N GI GI	F N CA M		

305	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y CS –	C Y F –	C Y F –	F Y CA –	N Y UG –	N Y UG –
b–	N N CS M	F Y UN –	N Y DF –	N Y CL –	F Y AO –	N Y UG –
c+	C Y CA –	C Y F –	C Y F –	F Y CL –	C Y MA –	C Y AO –
c–	F Y CL –	F N DF M	F Y F –	F N CL M	F Y DT –	F Y UG –

306	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N N GU –	N N GU –	N N GI GI	N N GU –		
b–						
c+						
c–						

307	Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
b+	N Y CS –	N N DF M	N N UN –	F Y CA –	N N GU –	N Y GU –
b–	F Y CA –	F Y F –	F Y F –	F N CA F	F Y AO –	N Y GU –
c+	N N GU –	C Y F –	C Y F –	C Y CA –	F Y UN –	C Y AO –
c–	F N GU –	– ? ? –	F N GU –			

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308	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	N	GI	GI	C	Y	CA	-	N	N	GI	GI	C	Y	AO	-
b-	F	N	CA	F	F	Y	F	-	F	Y	F	-	F	N	CA	F	N	N	GI	GI	N	Y	UG	-
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	N	N	GI	GI	C	Y	AO	-
c-	F	Y	CL	-	F	N	GU	-	N	N	GU	-	N	Y	GU	-	N	N	GI	GI	N	N	GU	-

309	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	N	CA	M	C	Y	F	-	C	N	UN	-	C	Y	C'	-	C	N	UN	-	C	N	GI	GI
b-	F	N	CA	M	F	N	GI	GI	N	N	UN	-	F	Y	CA	-	N	N	GI	GI	F	N	AO	M
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	N	GI	GI	C	N	UN	-
c-	F	N	CA	M	F	N	GI	GI	F	N	UN	-	F	N	GI	GI								

310	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	N	UN	-	C	Y	UN	-	C	Y	CA	-	C	Y	UN	-	C	Y	AO	-
b-	F	Y	UN	-	F	N	UN	-	N	N	GI	GI	F	N	UN	-	F	Y	UG	-	N	N	#F	M
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	Y	MA	-	C	Y	AO	-
c-	-	?	?	-	N	N	UN	-	N	N	UN	-												

311	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CA	-	N	Y	UN	-	N	N	HU	F	N	Y	#F	-	N	Y	UG	-	N	Y	UG	-
b-	N	Y	#F	-	F	N	UN	-	F	N	UN	-	N	Y	CL	-	N	Y	UG	-	N	Y	UG	-
c+	C	Y	CL	-	C	Y	F	-	C	N	GI	GI	C	Y	CA	-	C	N	UN	-	N	N	UG	M
c-	N	N	UN	-	N	N	UN	-	N	Y	UN	-	N	N	UN	-								

312	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	#F	–	C	N	OP	O	N	Y	#F	–	N	Y	#F	–	C	N	OP	O	N	Y	#F	–
b–	N	Y	#F	–	F	N	F	M	–	?	?	–	N	Y	#F	–	N	N	GI	GI	N	Y	#F	–
c+	C	N	CA	M	C	Y	F	–	C	N	UN	–	C	Y	CA	–	C	N	GI	GI	N	Y	UN	–
c–	F	Y	CL	–	–	?	?	–	N	N	GU	–	F	Y	CS	–	N	N	GI	GI	N	Y	UG	–

313	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	N	CA	M	N	N	GI	GI	N	Y	UN	–	N	N	UN	–								
b–																								
c+																								
c–																								

314	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	GU	–	N	Y	#F	–	N	N	UN	–	N	N	UN	–	N	Y	UG	–	N	Y	UN	–
b–	N	Y	UN	–	N	Y	#F	–	N	Y	HU	–	N	Y	UN	–	N	N	UN	–	N	Y	#F	–
c+	N	Y	CL	–	N	N	GU	–	N	N	GU	–	N	Y	HU	–	N	Y	HU	–	N	Y	#F	–
c–	N	N	GU	–	N	N	GU	–	N	Y	GU	–	N	N	GU	–	N	N	GU	–				

315	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	#F	–	N	N	DF	M	N	Y	UG	–	F	Y	CS	–	F	Y	F	–	F	Y	AO	–
b–	F	Y	CL	–	F	Y	F	–	F	Y	F	–	F	Y	CA	–	F	Y	UN	–	F	Y	AO	–
c+	F	Y	CA	–	F	Y	F	–	F	N	AO	M	F	Y	CS	–	F	N	UG	M	F	N	UG	F
c–	F	Y	CL	–	F	N	DF	M	F	Y	UG	–	F	Y	CS	–	F	Y	UG	–	F	Y	UG	–

316	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CS	–	C	N	UN	–	N	Y	UG	–	N	Y	CS	–	N	Y	UG	–	N	Y	UG	–
b–	N	Y	CS	–	N	Y	HU	–	N	N	UN	–	N	Y	#F	–	N	Y	UG	–	N	Y	UG	–
c+	N	Y	CS	–	N	N	GI	GI	N	N	HU	F	N	Y	CS	–	N	Y	UG	–	N	Y	UG	–
c–	N	N	UN	–	N	N	UN	–	N	N	HU	M												

317	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CL	–	C	N	F	M	C	Y	F	–	C	Y	CA	–	F	Y	AO	–	F	Y	AO	–
b–	N	N	CL	F	N	Y	DF	–	N	N	GI	GI	F	Y	CL	–	F	Y	AO	–	F	Y	AO	–
c+	C	N	CA	–	C	Y	F	–	C	Y	AO	–	C	N	CA	M	F	N	AO	M	N	N	#F	–
c–	F	Y	CA	–	N	N	#F	–	F	N	UG	M	F	Y	CS	–	F	Y	UG	–	F	Y	UG	–

318	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	N	F	M	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
b–	F	Y	CA	–	F	N	UN	–	F	Y	F	–	F	Y	CA	–	F	N	GU	–	F	N	GU	–
c+	C	Y	CA	–	C	N	F	M	C	Y	F	–	C	Y	CA	–	F	N	UN	–	C	Y	AO	–
c–	F	N	UN	–	N	N	UN	–	N	N	UN	–												

319	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	Y	CA	–	C	Y	F	–	F	N	UN	–	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
b–	F	Y	CA	–	F	Y	F	–	N	N	UN	–	F	Y	CA	–	F	Y	F	–	F	Y	AO	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	N	CA	M	C	Y	F	–	C	Y	AO	–
c–	–	?	?	–	N	N	GU	–	F	N	UN	–	F	N	GU	–								

320	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	Y	AO	–	N	Y	UN	–
b–	N	Y	HU	–	N	Y	HU	–	N	Y	HU	–	N	Y	#F	–	F	Y	AO	–	N	Y	UG	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	N	CA	M	C	N	F	M	C	Y	HU	–
c–	N	N	UN	–	N	Y	HU	–	N	Y	HU	–	N	N	UN	–	N	N	HU	–	N	N	[illegible]	M

321	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	–	C	N	F	M	C	Y	F	–	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
b–	F	Y	#F	–	F	Y	F	–	F	N	F	M	F	Y	CA	–	F	N	GI	GI	F	Y	AO	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	N	MA	M	C	Y	AO	–
c–	F	Y	CS	–	F	Y	F	–	F	N	AO	M	F	N	OP	O	F	Y	UN	–	F	Y	UG	–

322	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	#F	–	F	Y	F	–	F	Y	MA	–	N	Y	GU	–	N	Y	UN	–	N	Y	UN	–
b–	N	Y	UN	–	F	Y	F	–	F	N	F	M	F	Y	CA	–	F	Y	AO	–	F	Y	AO	–
c+	C	Y	CA	–	C	Y	F	–	C	Y		–	C	Y	CA	–	C	Y	MA	–	C	Y	F	–
c–	F	Y	CA	–	F	N	F	M	F	N	F	M	–	?	?	–								

323	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	#F	–	N	Y	DF	–	C	N	F	M	C	Y	CA	–	C	Y	MA	–	C	Y	AO	–
b–	N	N	CA	F	N	Y	DF	–	F	Y	AO	–	F	Y	CA	–	N	Y	UG	–	N	Y	UG	–
c+	C	Y	CA	–	C	Y	F	–	C	Y	F	–	C	Y	CA	–	C	Y	UG	–	C	Y	UG	–
c–	F	Y	CA	–	F	Y	F	–	F	N	F	M	F	Y	CA	–	N	Y	UG	–	F	Y	UG	–

324	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	Y	AO	-	C	Y	#F	-	C	Y	MA	-	C	Y	AO	-
b-	F	Y	CA	-	F	Y	F	-	F	N	F	M	F	Y	CA	-	F	Y	F	-	F	N	AO	M
c+	C	Y	CA	-	C	N	F	M	C	Y	AO	-	C	Y	CA	-	C	Y	F	-	C	Y	UG	-
c-	F	N	CS	M	F	N	F	M	F	N	F	M	F	Y	CL	-	N	Y	UG	-	F	Y	UG	-

325	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	CA	-	C	Y	F	-	C	Y	AO	-	C	N	CA	M	N	Y	UG	-	N	Y	UG	-
b-	N	Y	CA	-	N	Y	DF	-	N	N	GI	GI	N	Y	CA	-	N	Y	UG	-	N	Y	UG	-
c+	C	N	CA	M	C	N	F	M	C	N	F	M	C	N	UN	-	C	N	F	M	N	N	UG	M
c-	N	N	CL	M	N	N	GU	-	N	N	GU	-	N	N	UN	-								

326	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	Y	CA	-	C	Y	F	-	C	Y	AO	-	C	Y	CA	-	F	N	GI	GI	C	Y	AO	-
b-	F	Y	CA	-	F	Y	F	-	F	Y	F	-	N	N	UN	F	F	N	GI	GI	F	Y	AO	-
c+	C	Y	CA	-	C	Y	F	-	C	N	F	M	C	Y	CA	-	C	N	GI	GI	C	Y	F	-
c-	F	Y	CA	-	N	Y	F	-	N	N	UN	-	N	N	CA	M	N	N	GI	GI	N	N	UN	-

327	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	UN	-	N	Y	F	-	N	Y	UN	-	N	Y	CA	-	N	Y	UG	-	F	Y	UG	-
b-	F	Y	CS	-	F	Y	DF	-	F	N	UN	-	N	Y	#F	-	F	N	UN	-	F	Y	AO	-
c+	F	Y	CL	-	F	N	UN	-	F	N	UN	-	C	N	CA	-								
c-																								

328	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	F	Y	CA	-	F	N	UN	-	N	Y	UG	-	F	Y	CA	-	F	N	GI	GI	N	N	GI	GI
b-	F	Y	CA	-	N	N	GI	GI	N	N	UN	-	F	Y	CA	-	N	N	GI	GI	N	N	GI	GI
c+																								
c-																								

329	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	Y	UN	-	C	N	F	M	N	N	GI	GI	C	Y	CA	-	C	Y	MA	-	C	Y	AO	-
b-	F	Y	CA	-	F	Y	F	-	F	N	GI	GI	F	N	CA	M	F	Y	MA	-	F	Y	AO	-
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	Y	MA	-	C	Y	F	-
c-	F	Y	CA	-	F	N	F	M	F	N	UN	-	F	N	CA	M								

331	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CL	-	C	Y	MA	-	C	Y	AO	-
b-	N	Y	#F	-	N	Y	AO	-	N	Y	#F	-	N	Y	CL	-	N	Y	DT	-	N	Y	#F	-
c+	C	N	CA	M	C	Y	F	-	C	N	AO	M	C	Y	CA	-	C	Y	UN	-	C	Y	HU	-
c-	F	N	CA	M	F	Y	F	-	N	Y	UN	-	F	N	#F	-	N	Y	UG	-	N	Y	UG	-

332	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CS	-	C	Y	F	-	C	Y	T	-	N	Y	CL	-	N	Y	T	-	N	Y	UG	-
b-	N	Y	#F	-	N	Y	DT	-	N	Y	DT	-	N	Y	CL	-	N	Y	UG	-	N	Y	UG	-
c+	N	Y	CL	-	C	N	F	-	N	N	UN	-	N	Y	CL	-	N	Y	UG	-	N	N	UG	M
c-	N	Y	CL	-	N	Y	UG	-	N	Y	UG	-	N	Y	CL	-	N	N	UG	M	N	N	UG	M

333	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	C	N	F	F	C	N	UN	-	C	Y	CA	-	C	Y	UN	-	C	Y	AO	-
b-	N	Y	#F	-	N	Y	UN	-	F	Y	UG	-	F	Y	CA	-	N	Y	UN	-	F	Y	UG	-
c+	C	Y	CS	-	C	N	AO	M	C	Y	AO	-	C	Y	CL	-	C	Y	AO	-	C	Y	AO	-
c-	F	N	UN	-	F	N	MA	-	F	N	UG	M	F	N	CS	F	F	Y	UG	-	N	Y	HU	-

334	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	N	[illegible]	#F	-	N	Y	UN	-	F	Y	UN	-	N	Y	UN	-	N	Y	UN	-	N	Y	UN	-
b-	N	Y	CL	-	F	Y	DT	-	N	Y	UG	-	F	Y	CL	-	N	Y	UN	-	N	Y	UG	-
c+	C	N	CA	M	C	Y	F	-	N	N	UG	M	C	Y	CA	-	C	Y	MA	-	C	Y	AO	-
c-	-	?	?	-	-	?	?	-	-	?	?	-												

335	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CS	-	C	Y	F	-	C	Y	F	-	F	Y	CS	-	N	N	UG	M	F	Y	UG	-
b-	F		CA	M	F	Y	F	-	F	Y	F	-	F	Y	CS	-	F	N	UN	-	F	Y	AO	-
c+	C	Y	CA	-	C	N	F	M	C	Y	F	-	C	N	CA	M	C	N	F	M	N	N	UN	-
c-	N	N	GU	-	F	N	GI	GI	F	N	UN	-	F	Y	CL	-	N	N	GU	-				

336	Task 1				Task 2				Task 3				Task 4				Task 5				Task 6			
b+	C	Y	CA	-	N	N	UN	-	C	N	F	M	C	Y	CA	-	C	Y	MA	-	C	N	AO	M
b-	N	N	UN	-	N	N	UN	-	N	Y	UN	-	N	Y	CL	-	N	Y	GU	-	N	Y	UG	-
c+	C	Y	CA	-	C	Y	F	-	C	Y	F	-	C	Y	CA	-	C	Y	F	-	C	Y	UN	-
c-	N	Y	CA	-	N	N	UN	-	F	N	UN	-	N	Y	CL	-	N	N	UN	-	N	Y	UG	-

APPENDIX C

NUMBER SET ASSIGNMENT FOR NUMBER TRIPLES

Number Set Assignment

level	104	105	106	107	108	109	110	111	112	113	115	116	117	118	119	120
b+	2	1	5	5	1	2	4	1	3	3	4	3	3	4	1	3
b−	4	4	4	4	4	4	6	6	6	6	6	4	6	5	6	4
c+	4	3	4	4	3	4	3	2	2	2	3	5	2	3	2	3
c−	3	5	1	1	5	3	2	5	4	4	2	3	4	1	5	2

student ID #

level	123	124	127	128	129	130	131	132	133	134	135	136	139	140	141	142
b+	4	4	4	5	1	6	5	2	5	4	4	6	2	2	2	5
b−	1	1	1	3	2	1	1	5	1	2	2	4	1	5	1	3
c+	5	5	5	6	6	1	1	1	1	3	3	2	6	1	6	6
c−	1	1	1	1	4	5	6	3	6	4	4	3	3	3	3	1

student ID #

level	143	144	145	149	150	151	153	154	155	157	158	159	160	161	162	163
b+	2	2	6	5	4	4	1	1	5	3	3	6	2	3	2	5
b−	5	1	4	2	3	3	5	5	2	2	2	1	6	1	6	2
c+	1	6	2	6	3	3	5	5	6	1	1	1	1	4	1	6
c−	3	3	3	2	6	6	6	6	2	4	4	4	2	5	2	2

student ID #

level	165	166	167	168	169	171	172	173	175	176	177	203	205	206	207	208
b+	3	6	6	3	6	3	3	3	6	6	6	1	5	1	1	6
b−	1	3	3	1	3	5	5	5	2	2	2	4	1	3	4	1
c+	4	4	4	4	4	5	5	5	2	2	2	3	1	6	3	1
c−	5	6	6	5	6	4	4	4	1	1	1	5	6	5	5	5

student ID #

level	210	211	213	215	217	218	220	222	223	224	225	226	227	229	230	231
b+	1	3	3	4	4	4	4	5	2	5	2	5	2	5	2	3
b−	6	6	6	1	1	2	2	3	5	3	5	2	1	1	6	4
c+	2	2	2	5	5	3	3	6	1	6	3	6	6	1	1	5
c−	5	4	4	1	1	4	4	1	3	1	1	2	3	6	2	3

Number Set Assignment

student ID #

level		235	236	237	238	239	240	241	242	244	246	247	249	251	252	253	254
	b+	5	1	6	4	6	2	2	6	3	3	6	4	4	6	3	2
	b-	2	2	4	3	3	1	6	3	5	5	2	3	5	5	2	4
	c+	6	6	2	3	4	6	1	4	5	5	2	3	3	5	1	4
	c-	2	4	3	6	6	3	2	6	4	4	1	6	1	2	4	3

student ID #

level		256	257	258	260	261	262	264	266	267	268	269	270	271	301	302	303
	b+	2	5	6	5	6	3	1	4	2	1	1	1	5	5	5	6
	b-	4	6	4	4	5	1	5	6	3	6	3	5	4	1	1	2
	c+	4	4	2	4	5	4	5	3	1	2	6	5	4	1	1	2
	c-	3	2	3	1	2	5	6	2	5	5	5	6	1	6	6	1

student ID #

level		304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319
	b+	2	6	1	2	2	2	6	4	4	5	5	6	1	2	5	2
	b-	1	5	4	5	1	4	5	6	6	2	2	3	4	5	4	4
	c+	6	5	3	1	6	4	5	3	3	6	6	4	3	1	4	4
	c-	3	2	5	3	3	3	2	2	2	2	2	6	5	3	1	3

student ID #

level		320	321	322	323	324	325	326	327	328	329	331	332	333	334	335	336
	b+	5	4	6	3	3	3	1	4	3	3	1	1	1	3	4	6
	b-	4	3	3	6	6	5	3	3	5	2	6	6	3	2	1	2
	c+	4	3	4	2	2	5	6	3	5	1	2	2	6	1	5	2
	c-	1	6	6	4	4	4	5	6	4	4	5	5	[illegible]	4	1	1

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