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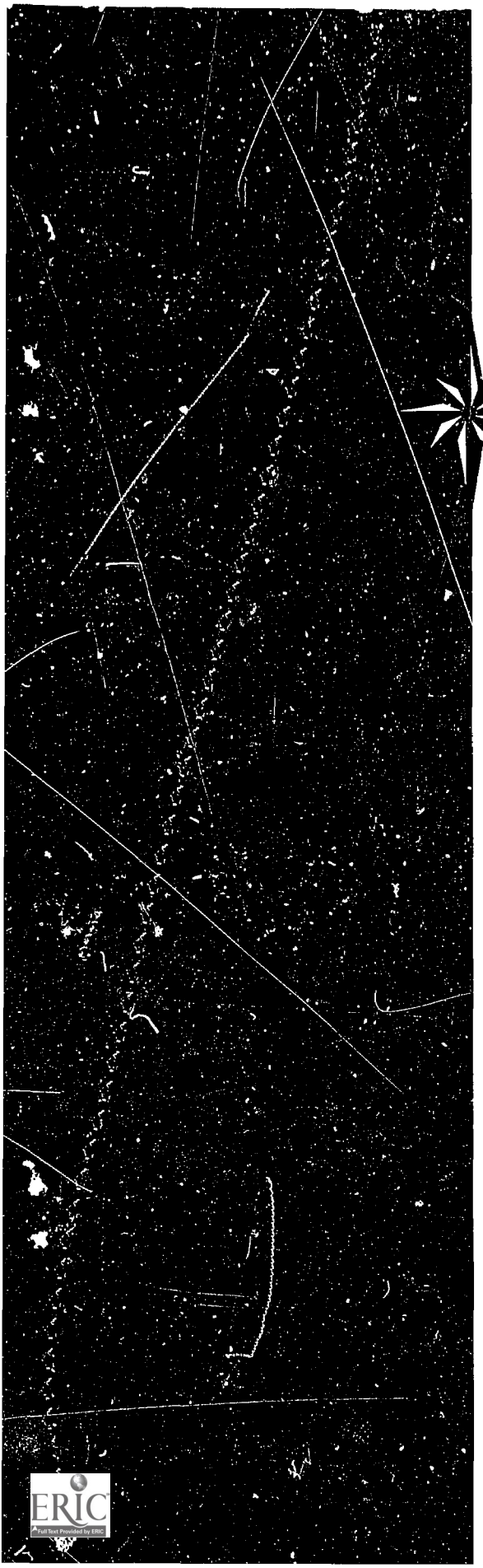
ABSTRACT

The methodology used in the evaluation of this unit is the same as that described in SO 000 433. Again seventy teachers participated along with 2,400 seventh through twelfth grade students. There were eight parts to this unit that were evaluated by the teachers: 1) The Population-Size and Spacing of Urban Settlements in a Region; 2) The Functions of Urban Settlements; 3) The Market Areas of Settlements; 4) Changes in the Urban System Over Time; 5) Interdependence Among Metropolitan Areas; 6) Hierarchy of Metropolitan Areas; 7) Accessibility; and, 8) Inter-Metropolitan Growth. The evaluation of each activity as in the other reports, included: a statement of the concept(s) it hoped to teach, a description of the exercises in each activity, and results of the unit test questions pertaining to that activity. The discussion also included general observations on: the clarity of directions, interest motivation effectiveness, and suggestions for revision based on the unit test results. Many teachers noted great interest in the content of the unit, however, they also felt that the readings and activities were unduly complex and confusing. The unit test and the results, the evaluation forms and the statistics are appended. See SO 000 433 for a list of related reports. (SBE)



NETWORKS OF CITIES:
Evaluation Report From a Limited School Trial of a Teaching Unit of the High School Geography Project

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CURRICULUM STUDIES
EDUCATIONAL TESTING SERVICE
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NOTE

The High School Geography Project is a course content improvement program in geography sponsored by the Association of American Geographers and supported by the National Science Foundation. The Project's goal is the development of new geography teaching materials at the tenth grade level. Current work is concentrated on development of materials following a course outline on a Settlement Theme.

Further information on the status and plans of the AAG project is available from:

High School Geography Project
P. O. Box 1095
Boulder, Colorado 80302

NETWORKS OF CITIES UNIT

Summary of Recommendations for Revising the Unit

The following suggestions summarize the major points made in the body of the report:

(1) Most teachers felt the concepts in the unit were generally appropriate for the students but that the manner in which the concepts were presented, that is, the readings and activities, was unduly complex and confusing.

(2) The test results and comments by teachers and students indicate that although the concepts of the unit were generally appropriate for the students, the reading materials were too difficult. A great deal of the vocabulary and sentence structure should be simplified, explanations of concepts should be expanded, and directions and questions for activities should be simplified. Teachers felt that their students needed step-by-step directions for completing many of the activities and for answering many of the questions. More of the reading material should be devoted to explanations of the concepts taught, possibly in the form of a summary of each activity. The data presented to the students should be condensed and reorganized to facilitate their use.

(3) The teacher's guidelines were inadequate in several respects and need revision. We suggest that an effort be made to coordinate the guide and the student materials more closely, making sure that all of the student readings and exercises are included in the guide.

Answers to student questions should be complete and clearly identified in the guide. Typographical and other errors were noted by teachers and should be avoided. We also suggest that more time be spent in providing the teacher with relevant geographic background, in suggesting supplementary reading materials for the students, in providing guidelines for evaluating student progress, and in suggesting a variety of learning activities. In general, the guidelines need to be expanded and more provisions need to be made for helping the teacher in the classroom.

(4) The unit is somewhat long and is difficult to teach in the three-week period provided. Either a shortening of parts of the unit or the addition of several class days is necessary.

(5) The unit test was judged by many teachers as being an inadequate measure of the unit as they had taught it. Although the difficulty of the unit itself may have contributed to this feeling, care should be taken to reduce the general level of the test vocabulary and to simplify the sentence structure and wordiness of the questions.

(6) The test results suggest that several of the activities were ineffective in helping students learn what was intended. Specific suggestions for revising the activities are made in the body of the report, and several activities should be significantly revised.

Description of the Limited School Trials

A. Purpose of Report

The evaluation report of the Networks of Cities unit is designed to serve two purposes. Of primary importance is the need to provide the unit authors and others responsible for the unit's revision with suggestions for modifying the unit. At the same time, statements about the unit's effectiveness are needed to assist in the development and revision of other units. It is hoped that this evaluation may be helpful in formulating materials which are even more effective in accomplishing the educational objectives of the High School Geography Project.

B. Background Information

The Networks of Cities unit is one of several units being developed by the High School Geography Project to constitute a geography course for high school students. The course is based on a settlement theme. This unit was previously tried out during the 1965-1966 school year with students in the area of Columbus, Ohio. On the basis of student and teacher reactions and test results designed to evaluate the unit's effectiveness, the unit was revised for the Limited School Trials.

The Limited School Trial of the Networks of Cities unit was held during the fall of 1966. It was one of five units taught, following the Introduction and the Inside the City units and preceding the Manufacturing unit and the Political Processes unit.

C. Evaluation Instruments*

At the beginning of the trial the participating teachers administered the verbal sections of the Cooperative School and College Ability Test (SCAT), Form 3A, to estimate the verbal ability of the students in relation to other high school students. The teachers also administered a pretest in geography. There were four different forms of the pretest, each consisting of questions from the unit tests of the five units in the Limited School Trials. Each form of the pretest was given to one-fourth of the students. Following the teaching of each unit, a unit test was administered to all of the students. A copy of the test is in Appendix D. At the end of each unit, students and teachers filled out forms evaluating the effectiveness of the entire unit. Teacher evaluations are in Appendix A and student evaluations are in Appendix C. Teachers also completed forms evaluating the different parts of the unit and their evaluations of the activities are in Appendix B. The suggestions for revising the unit that appear in this report are based on the results of the pretests, unit test, and on the evaluation forms completed by teachers and students. Analysis of student reactions was based on a twenty percent sample of student questionnaires.

D. Description of Teachers

There were seventy teachers selected for the Limited School Trials. Twenty-five of the teachers were instructed by the HSGP in the use of materials and objectives of the course, and fifty teachers were given no instruction in the use of materials (although twenty-five of these later teachers have had experience with earlier HSGP materials).

*The evaluation instruments (except SCAT, Form 3A) used can be found in the Appendices.

The seventy teachers were located in fourteen cities throughout the country. Fifty of the teachers taught in the West or Midwest.

According to information obtained by the HSGP, the mean number of semester hours in geography of the seventy teachers was approximately fifteen, and the mean number of semester hours in history, sociology, economics, and other social sciences was approximately forty-nine. Almost sixty percent of the teachers had six or more years of teaching experience, although only thirty-five percent had been teaching geography for six years or more. Twenty of the teachers had majored in geography as either undergraduate or graduate students. Sixty-four of the seventy teachers taught the unit in public schools, three taught in parochial schools, and three in independent schools.

E. Description of the Students

The total number of students in the trial of the Networks of Cities unit was 2,400. Approximately sixty percent of the students were ninth graders, twenty-one percent were tenth graders, ten percent were twelfth graders, five percent were eleventh graders, and four percent were seventh or eighth graders. About half of the participating students came from schools with a total enrollment between 750 and 1,500.

Performance of the students on the verbal section of the Cooperative School and College Ability Test (SCAT) varied considerably according to grade level. The mean score of the students in the seventh and eighth grades indicates that these one hundred students were well above average in verbal ability, their mean score being equivalent to a position between the 82nd and 93rd percentiles for eighth grade SCAT

norms. The majority of all students were in the ninth grade, and their mean score was above average, being equivalent to a position between the 53rd and 71st percentiles for ninth grade SCAT norms. The tenth graders were somewhat below average in verbal ability, their mean score according to tenth-grade norms being equivalent to a position between the 38th and 57th percentiles. The eleventh and twelfth-grade students were slightly above average in verbal ability. The mean score of eleventh graders was between the 48th and 67th percentiles and the mean score of twelfth graders was between the 45th and 63rd percentiles.

The results of the verbal section of SCAT can be summarized as follows:

Grade	Number of students	Percentile rank according to appropriate grade norms
7 or 8	95	82-93
9	1,427	53-71
10	492	38-57
11	123	48-67
12	237	45-63

F. Description of the Unit

The Networks of Cities unit was prepared under the direction of Edward J. Taaffe and Leslie J. King. At present, the unit is expected to follow an Introduction to Geography unit and the Inside the City unit and to precede the Manufacturing unit.

The version of the Networks of Cities unit used in the 1966 trial was intended to require approximately three weeks of class time. All but one teacher taught the unit within this suggested time period, the average number of days spent on the unit being thirteen and one-half.

The unit was divided into eight activities, each designed to teach certain concepts of urban geography. Activities included all the identifiable and distinguishable educational experiences planned for the unit, including class discussions and individual projects.

The teachers were provided with guidelines which described the concepts to be taught by each activity, the material needed, a suggested procedure to follow in class, and answers to questions in the student materials. It also gave teachers a list of suggested reference books and articles. Each student was provided with a manual of readings and exercises. In addition, this unit contained many maps, charts, tables, and diagrams.

Test Results and General Impressions of the Unit

A. Results of the Unit Test*

The following test results are based on the forty-nine-question unit test administered at the end of the Networks of Cities unit. These are compared with the results of the identical questions which were given before the unit began. A copy of the test appears in Appendix D.

The unit test of forty-nine questions was designed to measure an understanding of the basic concepts taught in the unit. The unit test mean score was 22.7 and the standard deviation was 7.4. Reliability was .818. On the average, each of the forty-nine questions pertaining to this unit was answered correctly on the pretest by thirty-six percent of the students, while on the unit test each question was answered correctly by forty-seven percent of the students. Thus, from the pretest to the unit test there was a mean increase of eleven percent in the number of students answering the questions correctly. However, only forty-eight percent of the teachers felt that the unit test adequately measured the content of the unit as they had taught it. Twenty of the twenty-eight teachers who thought the unit test did not measure the content of the unit as they had taught it felt that the vocabulary used in the test was not consistent with the vocabulary in the unit and that the complex sentence structure in the questions obscured the questions' intent for many students. Several other teachers felt that

*One question on the unit test, number 29, was judged defective and was not included in the test analysis.

the concepts in the unit were tested in too abstract a manner and that the ideas conveyed in the unit were not sufficiently measured. Although the relatively poor test results may be partially a result of the inherent difficulty of the test questions, we do not feel that their difficulty is the sole reason. Analysis of individual questions and student and teacher reactions indicates that the difficulty of the unit for many students also contributed to the poor test results.

B. General Impressions of the Unit

The following observations about the Networks of Cities unit are based on the questionnaires filled out by teachers and students. Student impressions are based on a twenty percent sample (414) of student forms. From this sample, two additional groups, those who scored in the upper and lower quintiles on the verbal aptitude test, were isolated for comparison with the total sample. Teacher impressions are based on the responses of fifty-five teachers who completed the Teacher Unit Evaluation Form.

1. The Unit as a Whole

In general, the teachers felt that the intent of the Networks of Cities unit, to analyze the interactions and interdependencies of the system of cities, is worthwhile for high school students. Many teachers noted great interest by their students in the content of the unit and in the unit's presentation of concepts relevant to their students' lives.

However, the teachers expressed dissatisfaction with many aspects of the unit. By far the most persistent criticism was the difficulty of the reading material for the majority of the students. A detailed

analysis of the reading material is made in the next section of this report.

Aside from the reading materials, the subject matter in the unit was also judged as being generally inappropriate for the student population. Approximately two-thirds of the teachers felt that the subject matter was too complicated for the students, and only two teachers felt that it was too simple for students. The students in both of these classes were of above average ability. More than half of the teachers felt that the organization of the subject matter was either somewhat or generally poor. Many of these teachers commented that the presentation of the concepts was unnecessarily complex and that often simple ideas were made to look difficult. Another recurring criticism was the proliferation of maps, tables, and charts which tended to confuse the students and inhibit them from tackling the material. These comments and others seem to indicate that most teachers felt the concepts in the unit were generally appropriate for the students but that the manner in which the concepts were presented, that is, the readings and activities, was unduly complex and confusing.

Another major problem encountered by the teachers was the insufficient amount of time allowed to teach the unit. The restraint of the Limited School Trials required that the teachers finish the unit in the requested time. However, a great many teachers suggested that more time be allowed for one or more activities in the unit, and forty percent of the teachers suggested additional time when the unit is revised.

Student reactions to the unit were more favorable than one would expect from teacher impressions of their students' interest. Almost two-thirds of all students found the unit to be either extremely or

generally interesting. Students who scored in the lowest quintile on the verbal aptitude test indicated somewhat more interest in the unit (seventy-four percent said it was interesting) than the other students.

2. The Student Reading Materials

The reading materials in the Networks of Cities unit were judged to be much too difficult for the students by both the teachers and students. Many teachers also felt that the material in the teacher's guidelines was also too complex and insufficient to teach the unit. All other comments and criticisms of the unit and even the test results must be judged while keeping the difficulty of the readings in mind, since so much of the unit consists of the teacher's and students' ability to understand the written work. Approximately sixty percent of all students found the readings to be either generally uninteresting or dull. However, it appears that this may be a somewhat unreliable estimate and the actual degree of interest may be even less. This seems to be the case because about ten percent of the students who scored in the lowest quintile on the verbal ability test indicated that they thought the readings were extremely interesting, while only two percent of the students whose scores were in the highest quintile indicated extreme interest in the readings. Since a large number of all students stated that the readings were too difficult it seems unlikely that students with low verbal ability would find the readings more interesting than students with high verbal ability.

Almost all of the suggestions for revising the unit made by students concerned a simplification of some part of the reading. These suggestions stressed a simplification of the vocabulary, the questions

in the manual and in the test, and the directions for the activities. Many others also felt that the maps and charts should be put in a separate book for easier reference or that the manual be significantly reorganized so that the maps are next to the relevant activities.

Teachers tended to confirm the negative reactions of their students to the reading materials. Approximately eighty percent of the teachers felt that the readings were not clearly written and understandable for the majority of the students, all but two teachers thought that they were inappropriate for the below average students, and almost forty percent thought them inappropriate even for above average students. The majority of the teachers felt that the vocabulary was too technical and too advanced for the students and that the sentence structure was too complex. The directions for the activities were also judged to be too difficult for the students and insufficient for the students to work on their own. Teachers were equally divided as to their feelings about the organization of the reading materials for an instructor.

Approximately three-fourths of the teachers felt that there should be more readings in the unit, and only five teachers felt that the amount of reading material should be cut. Many teachers felt that the majority of the students' reading materials consisted of directions for doing the activities and that the materials should include a greater amount of information explaining the concepts to be taught by the activities, possibly in the form of a summary of each activity. Students should also be given some guide as to the reasons they are studying these concepts and the purpose of each activity. Many students and several teachers questioned why and how certain aspects of the unit were relevant and what a particular exercise proved when finished.

Another criticism of the student reading materials concerned the excessive amount of data, including maps, tables, and charts that are included. Many teachers felt that this data overwhelmed many capable students and created an illusion of difficulty that was unnecessary. The concepts in many of the activities could have been taught much more quickly and easily by eliminating certain data and condensing others. Many teachers also felt that the charts, maps, and tables were poorly organized. Students were forced to continually turn pages in order to locate the many things required for an activity. This was not only time consuming but it also discouraged students from completing or even attempting an activity or exercise. A separate book of data and/or a reduction in the number of tables, etc. should alleviate this problem.

C. Teacher's Guidelines

In general, teachers expressed dissatisfaction with many aspects of the teacher's guidelines.

Almost half of the teachers found it either somewhat or definitely inadequate in clarifying the objectives of the unit, a reinforcement of their feelings that a clear statement of the purposes of each activity and exercise is needed. Almost two-thirds of the teachers felt that the guidelines were inadequate in suggesting a variety of learning activities. This may be a reflection of the lack of interest many teachers felt in their students, but several teachers did suggest a change in orientation away from United States urban areas to foreign cities or to the problems of the city today.

Almost sixty percent of the teachers thought that the guidelines were inadequate in providing reference materials. Several teachers indicated that they had learned more from the student materials than from

the guide itself. And all but eight of the teachers responding felt that the guide was inadequate in suggesting supplementary reading materials for students.

Teachers noted several errors in the teacher's guide which are enumerated under the suggestions for revising each activity. Care should be taken to see that typographical and other errors are corrected since they cause concern among teachers and students. Many teachers also felt that there was a lack of coordination between the teacher's guidelines and the student materials, and that references in the teacher's guide to both manuals were confusing and cumbersome. All student material should be included in the teacher's guide, and answers to student questions should be answered for the teacher completely and clearly. Many teachers felt that the unit's materials assumed too much prior knowledge on the part of the teacher and his students, and that too much was left to the teacher and possible misinterpretation.

Suggestions for Revising the Unit

The Networks of Cities unit is divided into eight activities, each designed to develop an understanding of one or more of the unit's concepts. By relating each test question to one or more of the concepts, and thereby relating it to one of the activities of the unit, it is possible to analyze the extent to which students understand the concepts, as well as the extent to which each activity contributes to this understanding. The evaluation of each activity will include a statement of the concept(s) it hoped to teach, a description of the exercises in each activity, and results of the test questions pertaining to that activity. Test results will be reported in terms of the percent of students who correctly answered each question on the pretest versus the percent of these same students who correctly answered it on the unit test. This is followed by suggestions for revising the unit based on test results. The discussion of each activity will also include general observations made by the teachers and unit evaluators with respect to the following: (a) whether the student and teacher directions were clear; (b) whether the activity was effective in stimulating the interest of the students; (c) whether the activity was effective in helping the students learn what was intended; (d) whether the activity should be retained in the unit with or without revision, or whether it should be eliminated. These judgements will be followed by specific suggestions for revising the activity, based on teacher and student impressions and comments.

Questions 1 and 2 on the unit test were not directly related to any one concept or activity in the unit. Both questions tested the students' ability to read and locate directions on a map. On the pretest fifty-seven percent of the students were able to locate a settlement when given its location relative to another settlement (question 1) and on the unit test sixty-five percent of the students answered this correctly. Although almost two-thirds of the students correctly answered this question after the unit was taught, the curriculum developers might hope that almost all students would be able to perform this elementary task in geography. The same is true for question 2 which is a somewhat more complicated exercise in map reading. Only fifty-eight percent of the students answered this correctly on the unit test, an increase of fourteen percent over the pretest. The results of both of these questions indicate a significant lack in students' knowledge of basic map reading skills. Since this unit, and every unit in the HSGP course, require some map work as a preliminary for more complex knowledge, additional work on the fundamental principles of reading maps seems indicated.

Activity 1: The Population-Size and Spacing of Urban Settlements in a Region (fifty-four teachers reporting)

Activity 1 is designed to develop an understanding of the following concepts:

A. There is some regularity or order in the occurrence of the different sized settlements within any region. A hierarchy of settlements according to their population-size can be recognized.

B. There is some regularity or order in the location of different sized settlements within any region.

Activity 1 consists of three exercises. In Exercise 1 students classify settlements on a map and are led to see the development of a hierarchy of different sized settlements. Exercise 2 emphasizes the relationship between population-size hierarchy and the spacing of urban settlements. Exercise 3 is optional and reinforces the concepts taught in the first two exercises.

The unit test contained eight questions designed to measure the students' understanding of the concepts taught. The results of these questions and the concepts to which they are related are:

Question #	Concept	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
3	A	61	85	24
4	A	18	39	21
5	A	32	53	21
9	A	24	33	9
6	B	73	90	17
7	B	25	39	14
8	B	33	47	14
10	B	23	20	-3
		M 36%	M 51%	M 15%

An average of thirty-six percent of the students correctly answered each of the eight questions on the pretest (as compared with thirty-six percent for all questions). On the unit test, each question was correctly answered by an average of fifty-one percent of these same

students (as compared with forty-seven percent for all questions). Thus, from the pretest to the unit test there was a mean increase of fifteen percent in the number of students correctly answering the questions related to Activity 1 (as compared with a mean increase of eleven percent for all questions).

Questions 3 and 6 both show above average increases in the percentage of students answering correctly and were correctly answered on the unit test by almost all of the students. Both questions require students to differentiate between four types of settlements on a map and show that the unit has successfully conveyed this idea.

When the results of the other questions related to Activity 1 are separated from these questions, we find that an average of only twenty-six percent of the students answered each of the remaining six questions correctly on the pretest, increasing to only thirty-eight and one-half percent on the unit test.

Questions 4 and 7 require the students to transfer knowledge learned in Activity 1 to a graph representing these concepts. Very few students were able to do this on the pretest, and the unit test results indicate a need to emphasize this skill in the unit. In question 4, approximately one-third of the students selected as their answer a graph that represents a relationship directly opposite from the correct one, and in question 7 approximately one-fourth of the students made this same error.

The results of question 10 show that fewer students correctly identified an area typified by closely spaced urban centers on the unit test than on the pretest. Forty-five percent of the students thought

that a mining area would be a more closely spaced region than a corn-livestock farming area in Iowa. The cause of this confusion may be on page 9 of the teacher's guidelines where a mining area is selected to show clustering of settlements and where no mention is made of a corn-livestock farming area.

These results and those to questions 5, 8, and 9 indicate the need for greater stress of the basic concepts of the activity.

Over two-thirds of the teachers felt that the directions in the teacher's guide were clear, and about half felt that the student directions were clear. Only six percent of the teachers thought that the activity was very effective in stimulating student interest, but almost two-thirds of the teachers thought it was generally effective. However, over one-third of the teachers found the activity to be generally ineffective in this respect. Approximately two-thirds of the teachers thought that Activity 1 was either generally or extremely effective in helping students learn what was intended, but again a sizable number (about one-third) found it generally ineffective in this area. Approximately one-fourth of the teachers would retain the activity without revision, approximately two-thirds would make revisions in it, and only two percent of the teachers would not retain it in the unit.

Almost two-thirds of the students indicated that they found Activity 1 either extremely or generally interesting, and in comparison with other activities this was one of the most interesting activities in the unit.

Specific suggestions for improvements include:

1. Provide maps for question B in Exercise 1 to provide a basis for the discussion.

2. Clearly identify the answers to student questions in the teacher's guidelines. There is no answer given for question C on page 6 of the student materials and the answer to question A in Exercise 2 lists eighteen settlements, but the students are asked to measure the distances for only twelve settlements.

3. Clarify the explanation of the proportional circles on page 3 of the teacher's guidelines.

4. The vertical axis of the graph on page 13 of the student materials should be population size in 1,000's rather than in 10,000's.

5. Explain to the students exactly how they should measure the distances to the nearest neighbors (Exercise 2), whether by direct distance or by highways.

6. Simplify the wording and make more explicit the questions asked of the students. Teachers identified one or all of the exercises as being too difficult, and the primary problem was usually the complexity and/or ambiguity of the questions.

7. Two teachers recommended the filmstrip "Village, Town, and City" by McGraw Hill for this activity.

8. In Exercise 3 suggest that students plot every other or every fifth settlement rather than all one hundred of them since is is a time consuming exercise and loses its impact from too much busy work.

Activity 2: The Functions of Urban Settlements (fifty-one teachers reporting)

Activity 2 is designed to develop an understanding of one concept:

Every urban function has a threshold-size; these threshold-sizes define a functional hierarchy; there is a relationship between the population-size and spacing hierarchy and functional hierarchy.

Activity 2 consists of 2 exercises. The first exercise entails a functional classification of settlements and the second requires students to interpret a scatter-diagram to determine threshold-sizes for various functions and expected number of functions for various populations.

The unit test contained twelve questions designed to measure an understanding of the concept taught in Activity 2. The results of these questions are as follows:

Question #	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
11	20	24	4
12	26	46	20
13	32	58	26
14	21	60	39
15	46	50	4
16	19	19	0
17	43	55	12
18	44	66	22
19	36	42	6
20	24	27	3
21	52	67	15
22	50	67	17
	M 34½%	M 48½%	M 14%

An average of thirty-four and one-half percent of the students correctly answered each of the twelve questions on the pretest (as compared with thirty-six percent for all questions). On the unit test, each question was answered correctly by an average of forty-eight and one-half percent of these same students (as compared with forty-seven percent for all questions). Thus, from the pretest to the unit test there was a mean increase of fourteen percent in the number of students correctly answering the questions related to Activity 2 (as compared with eleven percent for all questions).

Five of the questions (11, 15, 16, 19, and 20) showed a less than average increase from pretest to unit test, and four of these questions (except 15) showed a less than average percentage correct on the unit test. Four of these five questions deal with interpreting a graph that represents population and function. In general, students were unable to interpret and explain a fundamental concept of Activity 2 that is dealt with in Exercise 2. Question 15 should be answered correctly from an elementary understanding of threshold level and half of the students were unable to do this. Almost one-third of the students chose an answer which indicates that they thought threshold level meant the greatest number, rather than the minimal number necessary. The results to question 17 indicate that forty-five percent of the students were unable to read a graph similar to one used in the activity. This basic knowledge is needed for much of the rest of the activity.

Over half of the teachers suggested allowing more time to complete this activity. Almost two-thirds of the teachers felt that the directions in the teacher's guidelines were clear, but almost two-thirds

felt that the students' directions were unclear. About half of the teachers felt the activity was generally effective in stimulating student interest, and about half also thought it effective in helping students learn what was intended. Over three-fourths of the teachers would retain the activity but with revisions, sixteen percent would retain it as it is, and six percent would eliminate it. Approximately one-fifth of the teachers thought that Activity 2 was the most effective activity in meeting the objectives of the unit.

Approximately forty percent of all students thought that the activity was either extremely or generally interesting.

Specific suggestions include:

1. In the teacher's guidelines the curves on the scatter diagram should be drawn in as mentioned on page 24.

2. Ten of the fifty teachers reporting on this activity indicated that Exercise 2 was the most difficult part of the activity for their students. Students had difficulty drawing the curves on the scatter diagram and answering the questions for the exercise. Teacher and student comments and test results indicate the need for a clearer explanation of threshold size. The directions and examples used here should be simplified.

3. The colors on the maps were confusing to many. Page 25 of the student materials suggests using red for cities and orange for towns and on the map on page 20 it looks as if orange is used for cities and yellow for towns.

Activity 3: The Market Areas of Settlements (fifty-one teachers reporting)

Activity 3 is designed to develop an understanding of the following concept:

There is a nesting of market areas that serves the needs of an entire region; every urban center has a market area, the size of which is related to the population-size of the center. It is possible to derive certain idealized patterns of market areas.

Activity 3 consists of two exercises. The first exercise introduces the students to a theoretical system of hexagonal market areas which is a model for the location of urban settlements. Exercise 2 focuses on the systems of equidistant market areas.

There were six questions on the unit test that were designed to measure the students' understanding of the concept taught by Activity 3. The results of these questions are:

Question #	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
23	60	80	20
24	63	83	20
25	28	42	14
26	23	33	10
27	37	49	12
28	21	41	20
	M 39%	M 55%	M 16%

An average of thirty-nine percent of the students correctly answered each of the six questions on the pretest (as compared with thirty-six percent for all questions). On the unit test, each question was correctly answered by an average of fifty-five percent of

these same students (as compared with forty-seven percent for all questions). Thus, from the pretest to the posttest, there was a mean increase of sixteen percent in the number of students correctly answering the question related to Activity 3 of the unit (as compared with eleven percent for all questions).

The results of questions 23 and 24 show that most students understand the basic concepts of a market area and its dependency on the population of the center and that the unit has contributed to this understanding. However, each of the remaining questions related to this activity was answered correctly by fewer than half of the students.

Question 25 requires a basic definition of the term market area and although many students learned this during the unit, over half of the students did not. Questions 26, 27, and 28 are based on a diagram of a theoretical system of hexagonal market areas. The unit test results indicate a need for additional emphasis and explanation of this concept. Question 29 was judged defective and has not been used in the evaluation of this activity.

Approximately half of the teachers suggested allowing more time for this activity. Over half of the teachers felt that the directions in the teacher's guidelines were clear, but almost two-thirds of them thought the directions in the student materials were not clear. Only one teacher felt that the activity was very effective in stimulating student interest and learning. About one-fifth of the teachers felt the activity was definitely ineffective in stimulating interest and learning, and about one-third felt that it was generally ineffective. Over two-thirds of the teachers would retain the unit with revisions,

about one-sixth would retain it without revision, and about one-fifth would not keep it in the unit. It was judged to be the least effective activity in the unit by about one-fourth of the teachers.

Student reactions to this activity were somewhat contradictory. About one-fifth of them found the activity extremely interesting, and almost one-fourth of the students felt that it was the most interesting activity in the unit and the one that had taught them the most. However, almost one-fifth of the students found the activity the least interesting in the unit, and nearly as many found it to be the most difficult. In general, those students who scored in the lowest quintile on SCAT expressed more interest in the activity, and almost one-third of these students felt that Activity 3 was the most interesting in the unit.

Specific suggestions for improvement include:

1. Ten teachers questioned the formula on page 34 of the teacher's guidelines. This should either be explained more fully, if judged necessary for the teacher to know, or eliminated. Many also questioned the value of asking students to verify that the hamlets are $2\sqrt{3}$ apart, since very few students were capable of performing this task.

2. Supply teachers with directions as to how to use the maps applying the hexagonal market area model to China. Explain the numbers used on the map.

3. Clarify the student directions for Exercise 1. Some students thought they were to color all settlement circles the same color. Many had difficulty drawing the nested pattern of hexagonal market areas, and one teacher mentioned that before using this he would like to be

educated in its use. Another class plotted market areas in the local area from a road map and this aided in their understanding.

4. About ten teachers noted that a great problem was teaching students the difference between the real and theoretical market areas. They mentioned that students had trouble "ignoring the assumptions made earlier" as requested on page 55 of the manual.

5. Many teachers also mentioned that their students encountered difficulty in drawing the equidistant market areas for Exercise 2. Students seemed hesitant to approximate and required explanations and step-by-step directions for completing this exercise.

6. Reword student questions for Exercise 2, especially question C.

Activity 4: Changes in the Urban System Over Time (forty-nine teachers reporting)

Activity 4 is designed to develop an understanding of the following concept:

The set of urban centers in the region is a dynamic system, there is growth in population-size and functional complexity, and these changes are reflected in the set of market areas.

Activity 4 consists of two exercises. Exercise 1 focuses attention on the changes that have occured in urban settlements in the last sixty years. Exercise 2 highlights these changes by studying the reorganization of educational districts in the same time period.

The unit test contained two questions designed to measure the students' understanding of the concepts taught in Activity 4. The results of these questions are:

Question #	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
30	36	52	16
31	28	30	2

Question 31 is directly related to points made in Exercise 1 of the activity. There was very little increase in the number of students answering it correctly on the unit test and about one-third of the students chose an answer that contradicts one of the basic concepts of the activity.

About ninety percent of the teachers felt that the directions in the teacher's guidelines and student materials were clear. It was thought to be one of the more effective activities in the unit in stimulating student interest and learning, with about three-fourths of the teachers judging it either generally or extremely effective in these respects. Almost half of the teachers would retain it in the unit without revision, and all but two other teachers suggested retaining it with some revisions.

Over half of the students judged the activity to be either generally or extremely interesting.

Specific suggestions for revision:

1. Include the School District Map for 1961 in the teacher's guidelines. Also place this map in the student materials next to the one for 1900. The reason for the consolidation of school districts might also be explained more fully.

2. The legends for the maps on pages 70 and 71 of the student materials show that rivers are represented by dots, but they are not so represented on the maps themselves.

3. The concept of inertia was confusing to several teachers and students. Students felt that it contradicted the idea of threshold, and one teacher wanted to know if inertia meant running stores at a loss or gradual disappearance of the function. The concept of inertia should either be clarified and expanded or eliminated.

4. Exercise 1 presented several problems to the students, including:

a. Why didn't Metropal increase in size since 1900?

b. Why did some urban centers disappear and others remain?

c. Why did the changes mentioned in question A take place?

In general, questions should be clarified and teachers should be given fuller explanations and answers.

5. The name of the town of Lane is missing from the 1900 Urban Centers map in the student materials.

6. The center of Dille appears on the School District map of 1900 but not on the 1961 map, while it is on the Urban Center map for 1900 but not for 1960.

Activity 5: Interdependence Among Metropolitan Areas (forty-eight teachers reporting)

Activity 5 is designed to develop an understanding of the following concept:

The large cities of the United States are interdependent. When observed at the national scale, they are seen to have considerable interaction with each other, as evidenced by the number of air passengers moving between them.

Activity 5 consists of three exercises. Exercise 1 is a study of an air passenger flow map. Exercise 2 introduces the factors of population and distance in a study of city interaction. Exercise 3 is an

analysis of a gravity model and its application to air passenger flow.

The unit test contained seven questions designed to measure students' understanding of the concept in Activity 5. The results of the questions are:

Question #	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
32	61	71	10
33	45	57	12
34	53	68	15
35	30	37	7
36	17	28	11
37	13	18	5
38	26	27	1
	M 35%	M 43%	M 8%

An average of thirty-five percent of the students correctly answered each of the seven questions on the pretest (as compared with thirty-six percent for all questions). On the unit test, each question was answered correctly by an average of forty-three percent of these same students (as compared with forty-seven percent for all questions). Thus, from the pretest to the unit test there was a mean increase of eight percent in the number of students correctly answering the questions related to Activity 5 (as compared with eleven percent for all questions).

Questions 32, 33, and 34 indicate that students are familiar with a representation of traffic in the form of a gravity model and that the unit has contributed to the students' understanding of accessibility.

The relatively large number of students who correctly answered these questions on the pretest may be a reflection of the fact that these students previously studied accessibility in a similar way when the Inside the City unit was taught.

The results of the other questions indicate a need for greater emphasis and direction on the major points made in this activity.

About two-thirds of the teachers felt that the directions in the teacher's guidelines were clear, and about half of them felt that the student directions were clear. Almost two-thirds of the teachers thought that the activity was either generally or very effective in stimulating student interest and in helping students learn. However, only twelve percent would retain the activity without revision and over eighty percent would retain it with some revisions.

Almost one-fifth of the students found the activity extremely interesting and over one-third found it generally interesting.

Twenty-seven of the forty-eight teachers reporting mentioned that the gravity model was the most difficult part of the activity for the students and even for some of the teachers. The following are among the suggestions made about Exercise 3:

1. Explain the formula on page 56 of the guide more fully and describe its value for the students.

2. Explain the difference between the actual and estimated air passenger flows more fully since many teachers and students expressed confusion.

3. Place figures 5A and 5C facing each other for ease in comparison.

4. Rephrase the questions for the exercise and provide students with the information needed to answer the questions. For example, include on the maps of air passenger flows all cities mentioned in the questions.

5. The estimated air passenger flow between Washington, D. C. and New York City is greater than the actual flow. Some students commented that this contradicts the answer to question C and that the actual traffic should be more than the estimated since the two cities are more than 100 miles apart. This exception to the rule should be explained to the students.

Activity 6: Hierarchy of Metropolitan Areas (forty-eight teachers reporting)

Activity 6 is designed to develop an understanding of the following concept:

The large cities of the United States can be viewed as a hierarchy of dominant and sub-dominant centers. The patterns of air passenger travel express the connections among the cities at the upper levels of this hierarchy. The increasingly prominant role of the largest cities is evident in the patterns shown on the maps in the following exercises.

Activity 6 consists of three exercises. They all deal with the concept of a hierarchy of urban settlements at the national level of the United States. Exercise 1 focuses on the dominance of certain cities in air traffic patterns. Exercise 2 is a comparison between expected and actual air traffic dominance patterns. Exercise 3 is a discussion of changes in dominance patterns since 1940.

There were three questions on the unit test related to the concept in Activity 6. The results of these questions are:

Question #	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
39	35	33	-2
40	27	45	18
41	32	52	20

Question 39 is related to Exercise 3 and the changes brought about by the introduction of jet service. The poor performance on this question and the decrease in the number of students correctly answering it indicates the need to emphasize these points. Questions 40 and 41 show a substantial increase from pretest to unit test. However, there remains much room for improvement, especially since both questions are based on the type of map used in the activity.

Over eighty percent of the teachers felt that the directions in the teacher's guidelines were clear, and about two-thirds of them felt that student directions were clear. Almost sixty percent felt that the activity was either generally or extremely effective in stimulating student interest, although over ten percent of them did feel that it was quite ineffective. Almost one-fourth of the teachers would retain the activity without revision, and all but two others would retain it with some revision.

Over half of the students thought that the activity was either extremely or generally interesting.

Specific suggestions for this activity are:

1. Teachers noted several errors on the maps in this activity:
   (a) Washington is dominated by New York and is colored "other" on the 1962 air passenger dominance map.

(b) In figure 6B in the student manual, New Orleans is colored brown and should be left blank to be colored red.

(c) In figure 6A Augusta is colored red for New York and is listed as being dominated by Atlanta.

Care should be taken to ensure accuracy in the production of all maps and tables in the materials.

2. There should be a more detailed explanation of the traffic shadow effect since several teachers raised questions about it. Perhaps an explanation of this and of distance effect could be included in the student materials.

3. Rephrase student questions and suggest a step-by-step method for arriving at the answers.

4. Expand the student reading "Changes Through Time" and make it more specific.

5. The students asked many questions that the teachers were unable to answer. (For example, why a city was dominated by one so far away rather than by a large, closer city.) The guidelines should prepare the teacher for such questions and should provide him with enough information to answer them.

6. Arrange both the teacher's guidelines and the student materials so that tables and maps can be easily compared. One teacher suggested separating all maps and tables from the book (as in Unit I).

Activity 7: Accessibility (forty-five teachers responding)

Activity 7 is designed to develop an understanding of the following concept:

The basic concept is one of accessibility of points in a network. The emphasis here is on linkages, and the students should come away

from the exercises with the realization that the idea of accessibility is a complex one which may be viewed in a number of ways. The differences between accessibility in a highway network and an airline network should become particularly clear. In the case of the highway, intermediate points are significant, as is the length of each link. In the air network, intermediate points are not important, and the length of each link is not very significant, at least within the Manufacturing Belt.

Activity 7 consists of five exercises. Exercises 1 and 2 are optional and attempt to measure highway accessibility in terms of the number of direct links between cities and in terms of the sum of the shortest paths needed to go from one city to all cities in a network. Exercises 3 and 4 attempt to measure highway accessibility by time-distance, the latter exercise adding isochrones to the student's map studies. Exercise 5 measures air accessibility by studying the number of jet services from one city to the others in a network.

The unit test contained six questions designed to measure an understanding of the concepts in Activity 7. The results of the questions are:

(See table on the following page)

Question #	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
42	52	54	2
43	48	51	3
44	39	33	-6
45	27	42	15
46	18	36	18
47	23	21	-2
	M 35%	M 40%	M 5%

An average of thirty-five percent of the students correctly answered each of the six questions on the pretest (as compared with thirty-six percent for all questions). On the unit test, each question was correctly answered by an average of forty percent of these same students (as compared with forty-seven percent for all questions). Thus, from the pretest to the posttest, there was a mean increase of five percent in the number of students correctly answering the questions related to Activity 7 of the unit (as compared with eleven percent for all questions).

Questions 42, 43, and 44 refer to maps of hypothetical highway and airline transportation networks similar to exercises in the activity. For each of these three questions, there is a very low increase (or decrease) from pretest to unit test and this must reflect on the effectiveness of Activity 7. The decrease in the number of students correctly answering question 44 may possibly be explained by a confusion between the two maps, since one-fourth of the students chose a center which was most accessible in the highway map but not in the airline map. However, one of the main objectives of the activity, that students be able to distinguish between airline and highway routes, has not been achieved.

Although questions 45 and 46 showed a substantial increase, there remains a great deal of room for improvement. In question 45 approximately one-fourth of the students selected D as the answer, which is partially substantiated by a statement on page 84 of the teacher's guide, and it may be that either the question or the text is ambiguous. The reasoning behind question 46 is not explicitly stated in the text materials for the unit, and therefore the large number of students who selected A is somewhat understandable. Question 47 was very difficult for the students, and this may indicate further discussion of the various measures of accessibility needs to be included.

Almost half of the teachers suggested allowing more time for the teaching of Activity 7. About three-fourths of the teachers thought that the directions in the guide were clear for this activity, and about two-thirds of them felt that the student directions were clear. There was some disagreement as to the activity's effectiveness, with approximately one-sixth of the teachers feeling it was the most effective activity in meeting the unit's objectives and as many feeling that it was the least effective. However, over half of the teachers thought it was either generally or very effective in stimulating interest and learning, about one-third would retain it without revision, and only four teachers would eliminate it from the unit.

Almost half of the students found the activity either extremely or generally interesting, and it seemed to be more interesting to students who scored in the lowest SCAT quintile. About one-fifth of the students who scored in the highest SCAT quintile felt that this was the least interesting activity in the unit.

Specific suggestions follow:

1. Both teachers and students encountered difficulty with the isochrone map and requested additional explanations of this.

2. Include answers to Table A (Exercise 1) and Table C (Exercise 3) in the teacher's guidelines.

3. For Exercises 1 and 2 the students should be explicitly instructed as to the method of counting links, and they should be given a clearer definition of linkages.

4. The links around Lake Michigan are unclear. Is there a direct link between Chicago and Gary?

5. About ten teachers commented that they felt there were too many tables and maps for the relatively simple concepts taught, and that by eliminating many of them and by condensing others a more worthwhile and interesting activity would emerge.

6. Rephrase questions to make them more immediate and concrete problems for the students. One teacher gave his students a series of hypothetical situations, such as arranging for Mr. X to go from Chicago to Indiana for a meeting at 10:30, to St. Louis for a demonstration by 3:00, etc. He found much more student interest and a willingness to tackle the problem with this approach.

Activity 8: Inter-Metropolitan Growth (thirty-nine teachers reporting)

Activity 8 is designed to develop an understanding of the following concept:

The tendency for the large cities, in many parts of the country, to grow together is best illustrated in Megalopolis--the highly urbanized region stretching along the Atlantic Seaboard from southern New Hampshire

to the Virginia-North Carolina border area. The process is one of suburban and exurban expansion out from each city, resulting in a relatively continuous zone of urban and suburban densities.

Activity 8 consists of two exercises. Exercise 1 compares the density of settlements in Megalopolis since 1900. Exercise 2 illustrates the population growth pattern from 1930 to 1960 in the same area.

The unit test contained three questions designed to measure the students' understanding of the concept in Activity 8. The results of these questions are:

Question #	Pretest (% of Students Answering Correctly)	Posttest (% of Students Answering Correctly)	Increase in % of Students Answering Correctly
48	37	34	-3
49	14	16	2
50	56	43	-13

Since many of the classes were not able to complete Activity 8, the results of these three test questions may be somewhat misleading. However, the decrease in the number of students answering two of them correctly, and the very slight increase in the third, indicates that Activity 8 has not successfully conveyed its major points. Questions 48 and 50 test the main concept of the activity and less than half of the students were able to answer each correctly. The facts tested by question 49 are not specifically stated in the unit.

About half of the teachers suggested allowing more time to teach the activity. Almost ninety percent of the teachers felt that the directions in the teacher's guidelines were clear, and about three-fourths of them felt that the student directions were clear. About fifteen per-

cent of the teachers felt that it was the least effective activity, although three teachers felt it was the most effective. Over half of the teachers felt that it was either generally or extremely effective in stimulating student interest and learning. About ten percent of the teachers would retain it without revision, one teacher would eliminate it, and the others would retain it with revisions.

Almost half of the students thought that the activity was either extremely or generally interesting.

Specific suggestions include:

1. The questions on page 53 of the student materials should be answered more fully for the teacher.

2. Twenty of the thirty-nine teachers commented that they and their students felt that the amount of coloring required in the activity was excessive and contributed to boredom. More of the maps should be colored in for the students.

3. Students need step-by-step directions in order to successfully complete these exercises. Fewer maps and tables and more complete maps would leave more time for the discussion of the concepts.

Final Note

The work reported here is only one portion of the effort to test in the classroom the units being developed by the High School Geography Project. It seems important, considering the difficulty of the task of evaluation, to comment briefly about the uses of the data and suggestions that are appropriate.

First, it should be possible to revise. expand, and rewrite certain portions of the student materials.

Secondly, it should be possible to improve the test instrument so that eventual use of the items by classroom teachers may be more helpful.

And finally, it should be possible now to design and execute a much larger study of the usefulness, appropriate student populations for the unit work, and results to be expected from use of the materials.

The classroom trial of this unit has partially set the stage for the fruitful investigation, with a representative sample of schools, of the HSGP Settlement Theme course. Therefore, we end our report with a note calling for that research and investigation as the materials become available.

Appendices

APPENDIX A

TEACHER EVALUATIONS OF THE NETWORKS OF CITIES UNIT
(% of teachers responding)
(N=55)

A. Reading Materials

	Yes	No	Omit
1. Do you believe the reading materials are clearly written and understandable for the average student?	18	80	2
2. Do you believe the reading materials are clearly written and understandable for the above average student?	60	38	2
3. Do you believe the reading materials are clearly written and understandable for the below average student?	4	94	2
4. Do you believe the reading materials are well-organized from an instructor's point of view?	49	47	4
5. Should there be more student reading in the unit?	67	22	11
6. Should there be less student reading in the unit?	9	78	13

B. The Subject Matter in the Unit

7. Is the subject matter of the unit too complicated for students?	65	31	4
8. Is the subject matter of the unit too simple for students?	4	92	4

9. How would you rate the manner in which the subject matter is organized?

4 Excellent 36 Generally good 36 Somewhat poor 13 Definitely poor 11 Omit

C. Teacher's Guidelines

How helpful were the teacher's guidelines in

10. Clarifying the objectives of the unit?

11 Very helpful 42 Generally helpful 40 Somewhat inadequate 77 Definitely inadequate

11. Suggesting a variety of learning activities?

4 Very helpful 33 Generally helpful 52 Somewhat inadequate 11 Definitely inadequate

12. Providing needed geographical background, including suggested reference books?

7 Very helpful 33 Generally helpful 43 Somewhat inadequate 13 Definitely inadequate 4 Omit

13. Suggesting supplementary reading materials for students?

    0 Very helpful 15 Generally helpful 51 Somewhat inadequate
    23 Definitely inadequate 11 Omit

14. Providing guidelines for continuous evaluation of student progress?

    0 Very helpful 22 Generally helpful 42 Somewhat inadequate
    33 Definitely inadequate 2 Omit

D. The Unit as a Whole

	Yes	No	Omit
15. Did the unit test adequately measure the content of the unit as you taught it?	47	51	2

16. Which activity was MOST effective in meeting the objectives of the unit?

Activity 1 - 11	Activity 5 - 2	1 and 2 - 4
2 - 20	6 - 0	2, 3, and 4 - 2
3 - 5	7 - 16	Omit - 25
4 - 7	8 - 7	

17. Which activity was LEAST effective in meeting the objectives of the unit?

Activity 1 - 4	Activity 5 - 4	7 and 8 - 2
2 - 4	6 - 5	Omit - 22
3 - 25	7 - 16	
4 - 4	8 - 15	

18. Teachers were to indicate their judgment about the degree of interest each activity had for the majority of students. In the column at the far right each activity was rated as follows: A essential to the unit; B could be made optional; C should be dropped or significantly revised. Only 48 of the 70 teachers completed this part of the evaluation form. The percentage of the 48 teachers who responded in the indicated way is recorded.

Activity	Omit	Extremely Interesting	Generally Interesting	Generally Uninteresting	Dull	Rating
1	3	12	69	12	4	A-46 B-10 C- 2
2	6	10	56	18	10	A-40 B- 6 C-24
3	4	6	32	36	22	A-20 B- 6 C-42
4	10	10	54	18	8	A-32 B-16 C-20
5	14	10	54	16	6	A-34 B-10 C-20
6	16	2	44	26	12	A-34 B-14 C-14
7	16	12	36	22	14	A-30 B-10 C-20
8	16	8	38	18	10	A-20 B-16 C-24

APPENDIX B

TEACHER EVALUATIONS OF THE NETWORKS OF CITIES UNIT ACTIVITIES (CHART I)

Activity #	# of Teachers Reporting	Mean # of Class Minutes Spent on Activity	% Suggesting More Time for Activity	% Thinking Teacher's Guide Directions Clear		% Thinking Student Directions Clear	
				NO	YES	NO	YES
1	54	95	28	31	69	43	54
2	51	100	56	36	64	63	38
3	51	95	50	33	59	63	34
4	49	50	12	8	91	14	85
5	48	65	28	33	63	43	53
6	48	70	38	12	81	27	66
7	45	80	47	25	75	31	62
8	39	65	50	13	87	26	74

TEACHER EVALUATIONS OF THE NETWORKS OF CITIES UNIT ACTIVITIES (CHART II)
(% of teachers responding)

	Effectiveness in Stimulating Student Interest				Effectiveness in Helping Students Learn What Was Intended				Opinion on Whether Activity Should Be Retained in Unit			Number of Teachers Reporting
Activity	Very Effective	Generally Effective	Generally Ineffective	Definitely Ineffective	Very Effective	Generally Effective	Generally Ineffective	Definitely Ineffective	Yes, without Revision	Yes, With Revision	No	
1	6	59	33	2	13	52	33	2	28	65	2	54
2	12	41	4	8	14	36	45	6	16	78	6	51
3	2	39	35	4	2	45	33	20	14	68	18	51
4	12	64	20	4	29	49	20	2	49	45	4	49
5	8	58	30	4	4	56	37	4	12	84	4	48
6	12	47	36	6	22	36	36	6	24	70	4	48
7	24	31	31	14	18	40	31	11	31	58	11	45
8	10	46	36	8	13	44	39	3	10	85	3	39

APPENDIX C

STUDENT EVALUATIONS OF THE NETWORKS OF CITIES UNIT ACTIVITIES (CHART I)*

Omit or Did Not Remember				Activity	Extremely Interesting				Generally Interesting				Generally Uninteresting				Dull			
High	Middle	Low	Total		High	Middle	Low	Total	High	Middle	Low	Total	High	Middle	Low	Total	High	Middle	Low	Total
2	1	0	1	Unit as a whole	6	4	18	7	62	56	56	57	19	30	18	25	12	8	5	8
2	2	2	2	Reading Materials	2	3	11	4	40	36	37	37	42	42	35	40	15	20	13	18
2	2	7	3	1	10	11	19	12	50	55	49	53	30	22	17	23	10	9	7	9
2	2	6	3	2	10	10	18	12	55	48	46	49	24	31	25	28	10	10	3	9
6	7	7	7	3	15	16	23	17	40	43	42	42	32	29	17	27	8	7	9	8
12	10	9	10	4	8	11	15	11	43	42	49	45	29	27	14	25	9	8	11	9
5	10	6	8	5	13	14	21	17	51	37	45	41	20	30	19	26	12	8	8	9
10	16	13	14	6	21	10	25	15	36	38	38	38	22	27	16	24	12	8	7	9
12	17	11	15	7	7	12	17	12	33	32	47	35	39	28	14	25	12	10	10	11
13	24	18	21	8	14	10	18	12	31	31	38	32	31	21	18	22	12	13	7	12

*Student evaluations are based on response of a 20% sample of papers. Students were to indicate their degree of interest in each activity listed. The middle column lists the percentages of the 246 students who scored in the middle 60% on SCAT. The High and Low columnslist the responses of the sample students who scored in the high and low quintiles on SCAT, 86 and 82 students respectively.

APPENDIX C

STUDENT EVALUATIONS OF THE NETWORKS OF CITIES UNIT ACTIVITIES (CHART II)*

Activity #	% of Students Who Found It MOST INTERESTING				% of Students Who Found It LEAST INTERESTING				% of Students Who Found It Taught Them The Most				% of Students Who Found It MOST DIFFICULT			
	High	Middle	Low	Total	High	Middle	Low	Total	High	Middle	Low	Total	High	Middle	Low	Total
1	20	13	13	14	7	12	12	11	16	13	8	13	6	6	5	6
2	8	11	8	10	9	8	11	9	15	13	7	12	9	10	17	11
3	16	22	30	22	22	18	16	19	12	20	18	18	20	17	14	17
4	5	8	6	7	8	9	16	10	3	8	14	8	3	5	6	5
5	15	11	8	11	12	10	10	8	15	8	11	10	11	7	11	9
6	14	8	9	9	8	[illegible]	7	7	12	11	17	12	7	12	2	9
7	7	10	9	9	21	11	7	14	7	14	7	11	15	12	10	12
8	9	11	7	10	8	10	6	9	15	6	7	8	5	8	13	8
Omit	7	6	9	7	4	7	6	6	6	6	6	6	24	20	16	20
Readings	0	0	2	0	2	8	8	7	0	0	5	1	0	3	6	3

*Student evaluations are based on response of a 20% sample of papers. The middle column lists the percentages of the 246 students who scored in the middle 60% on SCAT. The High and Low columnslist the responses of the sample students who scored in the high and low quintiles on SCAT, 86 and 82 students respectively.

APPENDIX D

FORM OHS2

NETWORKS OF CITIES UNIT TEST

Time—40 minutes

YOU ARE TO INDICATE ALL YOUR ANSWERS ON THE SEPARATE ANSWER SHEET. No credit will be given for anything written in the test book. After you have decided which of the suggested answers you want to give for a question, blacken the corresponding space on the answer sheet.

Example:	Sample Answer
Chicago is a	A ▭
(A) state	B ■
(B) city	C ▭
(C) country	D ▭
(D) continent	

Give only one answer to each question; no credit will be given for multiple answers. If you wish to change an answer, erase your first line completely and mark your new choice.

DO NOT OPEN THIS BOOK UNTIL YOU ARE TOLD TO DO SO.

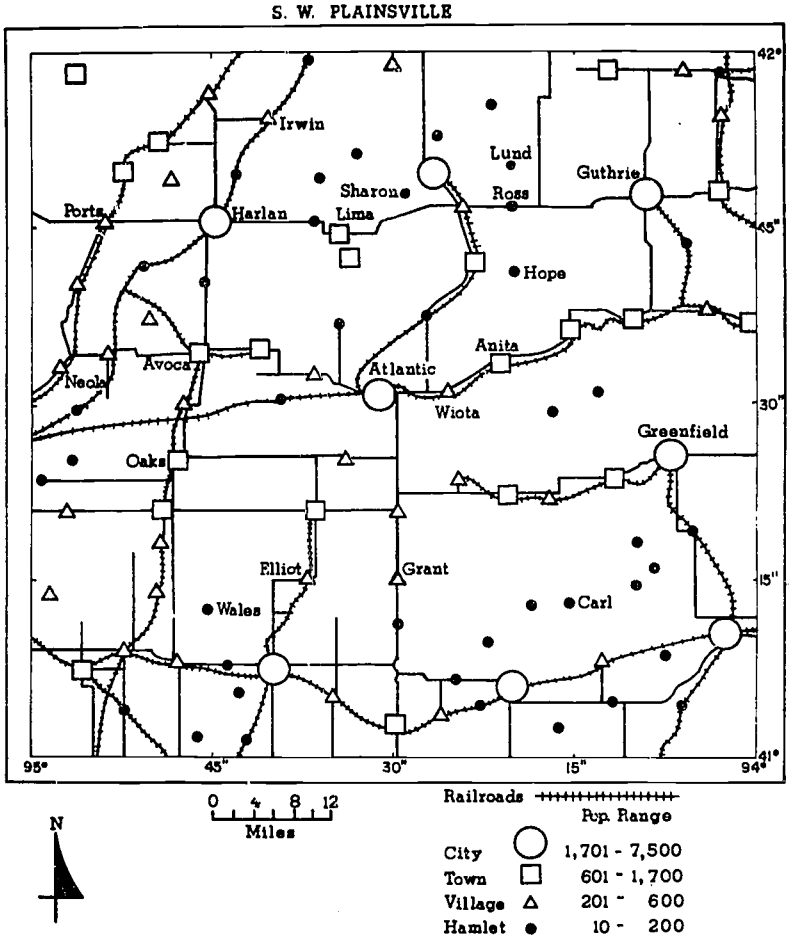
NETWORKS OF CITIES UNIT TEST

Time—40 minutes

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one which is best in each case and then blacken the corresponding space on the answer sheet.

Questions 1-8

S. W. PLAINSVILLE



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1. Which of the following settlements is located southeast of Atlantic?

   (A) Anita
   (B) Wiota
   (C) Carl
   (D) Wales

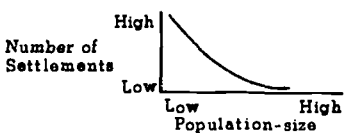
2. Assume that you are driving west from Atlantic. At the second town turn right and continue until you reach the first turn to the east. Make this turn and drive for eight miles. What is the name of the settlement you have reached?

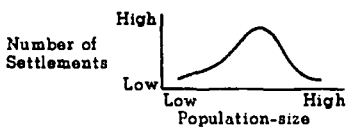
   (A) Harlan
   (B) Lima
   (C) Ports
   (D) Oaks

3. In the region shown on the map, which type of settlement occurs most frequently?

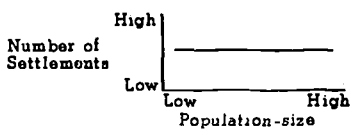
   (A) City
   (B) Town
   (C) Village
   (D) Hamlet

4. Which of the following graphs best represents the relationship between the population-size and the number of settlements in the region?

   (A)
   

   (B)
   

   (C)
   

   (D)
   

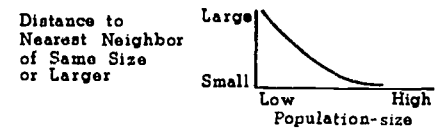
5. In the region illustrated by the map, the approximate range in urban center population is

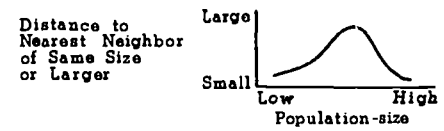
   (A) 10-1,701
   (B) 10-7,500
   (C) 200-1,700
   (D) 200-7,500

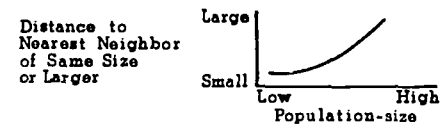
6. In the region illustrated by the map, which of the following appear, on the average, to be farthest apart?

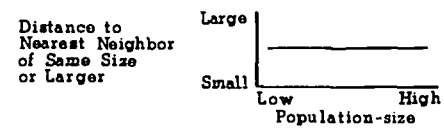
   (A) Hamlets
   (B) Villages
   (C) Towns
   (D) Cities

7. Which of the following graphs best represents the relationship between the population-size and the spacing of settlements in the region? (Spacing of settlements means the distance between a settlement and its nearest neighbor of the same size or larger.)

   (A)
   

   (B)
   

   (C)
   

   (D)
   

8. The location and spacing of the different settlements within the region illustrated by the map probably reflect all of the following factors EXCEPT the

   (A) population-size of the settlements
   (B) density of rural farm population
   (C) pattern of transportation routes
   (D) rate of urban annexation in the cities

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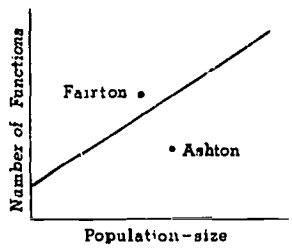
9. The use of the names "city," "town," "village," and "hamlet" in urban geography for describing urban settlements is a recognition of which of the following?

(A) The associated population-size levels are established by the United Statea Census Bureau.
(B) Arbitrary size groupings are useful in summarizing population-size characteristics.
(C) These divisions closely reflect variations in the population-size of the centers.
(D) These divisions closely reflect variations in the areal size (in square miles) of the centers.

10. In which of the following regions would you expect a system of interconnected and fairly closely spaced urban centers to be best developed?

(A) A corn-livestock farming area in Iowa
(B) A livestock-ranching area in Wyoming
(C) A mining area in Utah
(D) A lumbering area in Washington



11. The curve on this graph shows the relationship between the population-size of settlements and the total number of functions offered. Which factor might explain why Fairton has more functions for its population-size than the curve suggests it should have?

(A) There has been a steady increase in both functions and population at Fairton.
(B) Fairton is in an isolated location in a rich farming area.
(C) Fairton is located close to several larger centers.
(D) There has been a movement of functions from Fairton to Ashton.

12. In any urban center there are many goods and services that can be purchased. The threshold level of population required to support any such urban function probably will be smallest for a

(A) movie theater
(B) furniture store
(C) florist
(D) filling station

13. Which of the following is a correct statement about the relationship between type of urban center and the functions that the center offers?

(A) Functions with low thresholds occur in hamlets but in no other types of centers.
(B) Functions with low thresholds occur in hamlets and in all larger centers.
(C) Functions with high thresholds occur in villages and towns but not in cities.
(D) Functions with high thresholds occur in cities, villages, and hamlets but not in towns.

14. People generally are willing to travel the greatest distance to purchase

(A) food
(B) shirts
(C) pianos
(D) shoes

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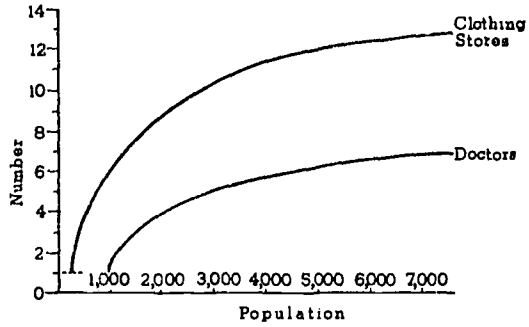
Questions 15-19.



15. According to the graph above, what is the approximate threshold level for a doctor's practice?

(A) 500
(B) 1,000
(C) 2,000
(D) 7,000

16. How much of an increase in population would be needed in order to double the number of clothing stores for a center of 1,000 population?

(A) 500
(B) 2,000
(C) 4,000
(D) 6,000

17. How many clothing stores would you expect to find in a city of 5,000?

(A) Six
(B) Eight
(C) Ten
(D) Twelve

18. If the same settlements are used to plot the two curves of the graph, which of the following statements is correct?

(A) Clothing stores have a lower threshold and are more numerous than doctors.
(B) Clothing stores have a lower threshold but are less numerous than doctors.
(C) Doctors have a lower threshold and are more numerous than clothing stores.
(D) Doctors have a higher threshold and are more numerous than clothing stores.

19. Which of the following helps to explain why the curve representing the number of clothing stores starts to flatten beyond a population of 5,000?

(A) Individual clothing stores tend to increase in size as centers increase in population.
(B) For this population, there are already enough clothing stores in the region.
(C) Demand for clothing per person is smaller when a large population is involved.
(D) As population increases, the threshold decreases.

---

20. Which of the following would best account for the fact that the threshold level for an urban function may vary from one region to another?

(A) Income levels
(B) Age of the urban center
(C) The variety of urban services offered
(D) Relative sizes of the rural and urban populations

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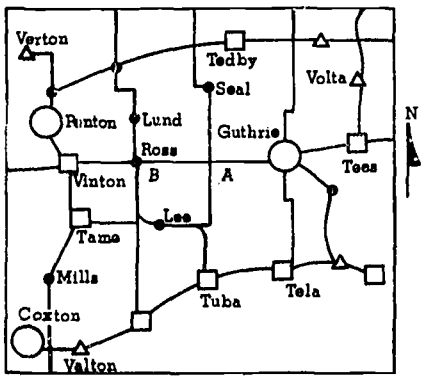
Questions 21-24 refer to the map below.



○	City	1,701 - 7,500
□	Town	601 - 1,700
△	Village	201 - 600
●	Hamlet	10 - 200

21. You are a farmer and your home is located at point A. If you wish to travel a minimum distance, where would you go to purchase gas? (A filling station has a threshold of 150 persons.)

(A) Ross
(B) Seal
(C) Guthrie
(D) Lee

22. If your neighbor lives at point B, where would he most likely go to purchase stock feeds? (A feed store has a threshold of 500.)

(A) Vinton
(B) Guthrie
(C) Ross
(D) Penton

23. A public accountant finds that in order to be financially successful he must locate in a city. If he locates in Guthrie he might reasonably expect to attract the accounting business from all of the following centers EXCEPT

(A) Tela
(B) Tedby
(C) Tame
(D) Tees

24. Assume that you live in the village of Verton and are interested in buying a product that is available in Vinton and Tedby. In which of the following centers could you also obtain this product?

(A) Penton
(B) Valton
(C) Ross
(D) Lund

25. The market area of an urban settlement is best defined by which of the following?

(A) The area around the settlement in which population density is constant
(B) The generalized trade area for the functions found in the settlement
(C) The trade area that is served by the function with the lowest threshold value in the settlement
(D) An area in which the number of functions is directly proportional to the areal extent of the settlement

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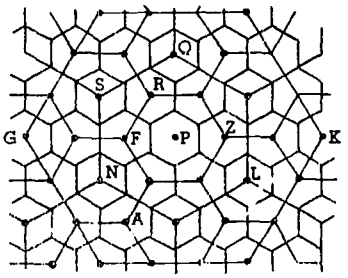
Questions 26-28 refer to the following diagram which represents a theoretical set of urban market areas and centers.



26. The idealized pattern of market areas and settlement locations illustrated in the diagram assumes all of the following factors EXCEPT

(A) uniform farm population density
(B) complete freedom of travel in all directions
(C) uniform income levels and shipping preferences
(D) a complete lack of rural-urban interaction

27. If travel becomes easier and faster on the highways connecting the urban centers shown above, the hexagons that represent the system of market areas might

(A) proportionally increase in size
(B) proportionally decrease in size
(C) expand at the center and contract at the edge
(D) increase in number

28. Assuming that R is a hamlet, which of the following would represent a village-town-city sequence of urban centers?

(A) R, S, N
(B) Q, G, P
(C) Q, S, N
(D) R, Z, P

29. The market area of a particular settlement grows in size. All of the following may account for such growth EXCEPT

(A) a decrease in rural population density
(B) the more rapid growth of nearby settlements
(C) an improved transportation network
(D) an increase in the population and number of functions

30. All of the following factors have contributed to a decline in the importance of hamlets EXCEPT

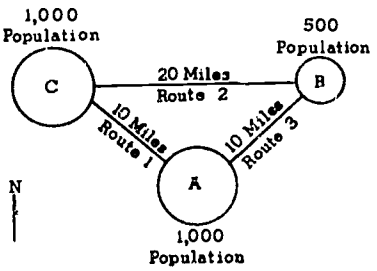
(A) increased ease of travel to larger centers
(B) better quality of services in larger centers
(C) accelerated population growth of most hamlets
(D) decline in rural population densities

31. In the United States over a period of time, all of the following changes have taken place in systems of urban settlements EXCEPT:

(A) Greater mobility has been associated with increased dominance of larger centers.
(B) The number of functions per capita of population has tended to increase in centers that are near metropolitan areas.
(C) Functions have tended to move from low-order to high-order centers.
(D) The market areas for low-order functions have tended to increase in size.

GO ON TO THE NEXT PAGE.

Questions 32-35 refer to the diagram below.



32. If traffic between two centers is related solely to their populations and to the distance between those centers, which of the following is correct?

(A) Route 1 would have the most traffic.
(B) Route 2 would have the most traffic.
(C) Route 3 would have the most traffic.
(D) All routes would have an equal amount of traffic.

33. If traffic between two centers is related solely to their populations and to the distance between these centers, the second greatest amount of traffic would most likely be

(A) over route 1
(B) over route 2
(C) over route 3
(D) impossible to determine

34. If the population of B were doubled, which of the following would most likely be true?

(A) Route 2 would have the most traffic.
(B) Route 3 would have the most traffic.
(C) Routes 2 and 3 would have the same amount of traffic.
(D) Routes 1 and 3 would have the same amount of traffic.

35. If a route is added to the northwest connecting C to a new center which has a population of 500, how far away could it be and still rank as the route with the greatest amount of traffic?

(A) 1 mi.
(B) 3 mi.
(C) 4 mi.
(D) 6 mi.

36. If one were to use population and distance as the sole basis for predicting the volume of air traffic between cities, the air traffic between which of the following would probably be overestimated?

(A) New York and Los Angeles
(B) New York and Kansas City
(C) New York and Dallas
(D) New York and Albany

37. For which of the following pairs of cities would population and distance provide the best estimate of air traffic volume?

(A) Chicago and Washington
(B) New York and Las Vegas
(C) Buffalo and Miami
(D) Chicago and Buffalo

38. Which of the following would occur if zones of influence were delimited according to the number of automobile trips between cities rather than the number of air passengers between cities?

(A) A larger number of regional centers would result.
(B) New York would dominate the entire country.
(C) There would be no noticeable difference between the patterns of automobile and airplane travel.
(D) Smaller cities near a given regional center would be less likely to be dominated by that center.

39. If a pattern of air passenger dominance showed that Omaha is dominated by Kansas City, that Kansas City and St. Louis are dominated by Chicago, and that Chicago is dominated by New York, the introduction of jet services would be LEAST likely to result in which of the following patterns?

(A) Omaha, Kansas City, and Chicago dominated by New York.
(B) Omaha dominated by Kansas City; Kansas City by St. Louis; Chicago by New York.
(C) Omaha and Kansas City dominated by Chicago; Chicago by New York.
(D) Omaha dominated by Kansas City; Kansas City and Chicago by New York.

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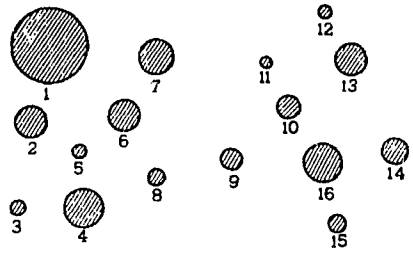
Questions 40-41 refer to the diagram below.

DIAGRAM OF URBAN CENTERS



City circle is proportional to population.

40. If City 8 is initially dominated by City 4, within which zone of influence would City 8 be likely to fall as transport technology improves?

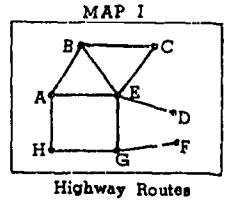
(A) City 1
(B) City 6
(C) City 7
(D) City 9

41. A typical pattern illustrating the idea of an urban hierarchy would be

(A) 11 dominated by 10, 10 by 16, and 16 by 1
(B) 2 dominated by 1, 7 by 1, and 6 by 7
(C) 11 dominated by 13, 13 by 16, and 16 by 4
(D) 8 dominated by 6, 9 by 6, and 6 by 16

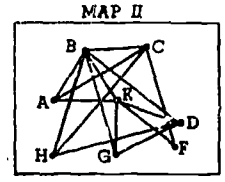
Questions 42-44 are based on hypothetical highway and airline transportation networks depicted in maps I and II.

MAP I



Highway Routes

MAP II



Airline Routes

42. If you assume that all centers on map II are of equal size and that flying time between all centers is equal, which center is most accessible to all other centers?

(A) A (B) B (C) C (D) D

43. How many steps are there in the shortest path between the two centers that are farthest apart on map I ?

(A) 1 (B) 2 (C) 3 (D) 4

44. Which of the following centers is most accessible to Center F in map II ?

(A) A (B) C (C) D (D) G

GO ON TO THE NEXT PAGE.

45. Which of the following would probably rate as the most accessible city in a highway network?

(A) A large city located in the middle of the network
(B) The largest city regardless of its location in the network
(C) A city located at the edge of the network
(D) A city of any size located in the middle of the network

46. Which of the following would probably rate as the most accessible city in an air transport network?

(A) A large city located in the middle of the network
(B) The largest city regardless of its location in the network
(C) A city located at the edge of the network
(D) A city of any size located in the middle of the network

47. If one were to compare Philadelphia with Chicago and Cleveland, which measure would give Philadelphia the highest accessibility rating?

(A) Number of highway links at the cities
(B) Total highway travel time to other major cities
(C) Number of scheduled jet aircraft connections to other major cities
(D) Total population within three hours' travel time

48. Since 1900, the pattern of growth of the cities on the Eastern Seaboard of the United States shows that there has been a

(A) rapid growth showing an increased concentration in the four or five major cities
(B) rapid growth from the major coastal cities back toward the interior
(C) period of rapid growth of all cities followed by a period of stability and a present period of slight decline
(D) period of rapid growth with high density settlement spreading to areas between major cities

49. Growth of Eastern Seaboard cities of the United States is principally associated with

(A) their excellent harbors and their resultant function as major port cities
(B) their predominant position among United States manufacturing cities
(C) their excellent transport connections to the rest of the country
(D) the financial, administrative, and other services that they provide to the rest of the country

50. Rapid population growth in the megalopolis area has been particularly noticeable in the

(A) four or five major cities
(B) western margins of the area
(C) areas surrounding the major cities
(D) northern rather than the southern parts of the area

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

APPENDIX E

The following words in the unit materials were mentioned by one or more teachers as being too difficult for their students and needing clarification:

1. Hierarchy
2. Threshold
3. Dominance
4. Accessibility
5. Urban Center
6. Market Areas
7. Rural Settlement (vs urban)
8. Population-Size
9. Central Place
10. Network
11. Nesting
12. Low-order Functions
13. High-order Functions
14. Spacing
15. Tributary Area
16. Equidistant
17. Interdependence
18. Intermediate
19. Isochrones
20. Suburban
21. Magalopolis
22. Density
23. Coalesce
24. Functional Range
25. Continium
26. Continuous Variable
27. Gravity Model
28. Concentration
29. Proportionate
30. Predominantly
31. Verify
32. Progression
33. Arbitrary
34. Relative
35. Anticipate
36. Variation
37. Activity 2: "Change Variation of No More than 5"
38. Generator
39. Traffic Shadow
40. Range
41. Migration
42. Social Forces
43. Strong Political Forces
44. Probability
45. Ascertaining
46. Total Interaction
47. Populatories
48. Flow Patterns
49. Tributary Region and Hinterland
50. Hyphenated Words (generally)