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ABSTRACT
                Information about the effect of changes in interest
rates and the length of repayment on mortgages is available through
the use of this loan and mortgage spreadsheet program designed for
use on Apple computers. It is especially designed to help people
evaluate the relative advantages of a variable rate mortgage with a
low initial rate of interest against mortgages with a higher but
fixed rate of interest. The program allows the user to determine
monthly payments for both types of mortgages and to calculate total
interest payments. The program has two major options, one for fixed
rate mortgages and one for variable rate mortgages. For fixed rate
mortgages up to ten different interest rates can be specified. For
adjustable rate mortgages the program allows the user to experiment
with different rates of increase and decrease. Procedures for
operating the program are detailed and the program is provided.
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LOAN AND MORTGAGE SPREADSHEET

by

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There was a time in days gone-by when deciding how to finance the purchase of a home was relatively simple. Interest rates were not only fairly uniform between different lending institutions, but the home buyer did not face the prospect of paying astronomical monthly payments and/or payments that fluctuated from one year to the next.

The home buyer of today is faced with a maze of options that can make the financing of a home a bewildering experience. As a result of several recent "creative" trends in home financing, a home buyer might be faced with interest rates that range between 10 to 15 percent. The following shows how different interest rates can affect monthly payments on a $100,000 mortgage for a term of 30 years:

INTEREST	MONTHLY PAYEMENT
10%	$877.57
11%	$952.32
12%	$1028.61
13%	$1106.2
14%	$1184.87
15%	$1264.44

The problem is not finding the lowest possible interest rate to finance a home; the problem involves deciding whether obtaining a loan with an initial low interest rate is worth the risk that the rate might increase in future years...and in some instances the increase could be drastic.

A major decision that a home buyer is faced with is whether to obtain a fixed-rate mortgage or adjustable rate mortgage (ARM). An ARM offers the home buyer an interest rate at what is usually an initial low level. At specified periods that interest rate is adjusted based on some index over which the lending institution has no control (e.g., Treasury securities index).

Consider this example of an ARM for a $100,000 30 year loan. The initial rate might be 11.5% which would result in monthly payments of $990.29. If this loan were a three year ARM, the bank or savings and loan would have the option of adjusting the interest rate after three years of payments have been made. Assume that this loan also has a 2% "cap" which means that the interest rate could not be increased by more than 2% for each adjustment period (and not all ARM's have caps!). After three years the new adjusted interest rate is 13.5% and the monthly payment is now $1140.02. After three more years the interest rate is adjusted again to 15.5% and the monthly payment increased to $1288.7.

The dilemma faced by the home buyer is very clear. Should the home buyer obtain a fixed-rate mortage, say at 14%, that would result in fixed monthly payments of $1184.87? Or should the home buyer secure an ARM as described above that would have initial monthly payments of $990.29, but that could increase to $1288.7 after six years?

Using the Program

The Loan and Mortgage Spreadsheet program will help-
the home buyer take some of the guesswork out of home finan-
cing. The program allows you to determine monthly pay-
ments for both fixed-rate and adjustable rate loans. For
each type of loan, the amount of the loan (i.e., principal),
the term of the loan, and/or the interest rates can be
changed to experiment with different loan situations.

The program has two major options. The first option
allows for the experimentation with fixed-rate-mortgages.
The following sample run illustrates program output for
a $75,000 fixed-rate loan for 30 years. For each fixed-rate
mortgage up to 10 different interest rates can be specified.
The fixed-rate option is initiated by entering F after the
prompt

FIXED OR ADJUST. INTEREST (F OR A)?

The amount of the loan or the initial principal is then
entered. In this example the loan is for $75,000. The term
of the loan is initially set at 30 years. The different interest
rates to be considered are then entered. After the last
interest rate is entered, the RETURN key is pressed and the
different program options for modifying variables will appear
at the bottom of the screen

Figure 1 about here

In Figure 1 seven different fixed-rate interest amounts
are shown, ranging from 14.125% to 14.755%. Many newspapers
print a weekly summary of both fixed-rate and adjustable
rate mortgages. For a $75,000 30 year loan, the monthly
payments will range from $896.08 to 933.66. For each
interest rate specified, the total interest paid over the
life of the loan is also printed. For the first interest
rate of 14.125%, where the monthly payment is $896.08, the
total interest paid over the life of the loan is $247,588.6.
The total interest is the number of payments made (or number
of years indicated multiplied by 12) times the monthly payment
value minus the initial principal.

To see what will happen if the term of the loan is
20 rather than 30 years, Y is entered after the prompt at
the bottom of the screen and then 20 entered after the
NUMBER OF YEARS prompt. The monthly payments and total
interest values are then recalculated and printed for each of
the fixed-rates specified. The output for a $75,000 20
year loan for the rates indicated are shown in Figure 2.

Figure 2 about here

The effects of changing the loan amount can be tested by
entering L after the variable decision prompt and
then entering the new loan amount. As shown in Figure 3,
the loan amount has been reduced from $75,000 to $50,000 for

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a 30 year term. As soon as the loan amount and term of the loan are changed, the monthly payments and total interest for each of the fixed-rates is recalculated and printed.

γ   Figure 3 about here

If desired new interest rates can be entered using the loan amount and term previously specified. This is accomplished by entering I after the prompt at the bottom of the screen.

The adjustable rate mortgage option is initiated by entering A after the initial program prompt. If you are already in the program, entering M after the variable decision prompt will send control to the beginning of the program and the initial program prompt.

The method for determining monthly payments for the adjustable rate option is as follows: after an adjustment has been made (an increase or decrease in the interest rate) monthly payments are calculated using the remaining balance for the remaining term for the new interest rate specified. Take note that there is no industry standard for calculating adjustable rate mortgages, and how interest rates are adjusted and/or what index is used to make the adjustment will vary from institution to institution.

To illustrate a typical adjustable mortgage, consider

a 3 year adjustable $75,000 30 year loan in which the initial
interest rate is 12.75%. The interest rate of 1   is
entered for the first three years to indicate the interest
rate for those years. To determine what would happen
if the interest rate is increased to 14.75% in the fourth
year, the 4th interest rate entered is 14.75. As shown
in Figure 4, the monthly payment increases from $815.02 to
$929.02 as a result of the two percent increase in the
interest rate.

Figure 4 about here

The scenario shown in Figure 4 represents a situation
in which there is a two percent adjustment cap and a 16 per-
cent loan cap. This means that no loan adjustment can be
greater than a two percent increase, and that the maximum
interest rate for the loan cannot exceed 16 percent. The
output in Figure 4 illustrates the worst possible scenario
or what would happen if all the maximum increases allowable took
place. The last interest rate of 16% indicates that the
interest rate for the remaining 24 years of the loan is 16
percent.

Because different interest rates are used, the total
amount of interest paid over the term of the loan must be

determined for each of the different interest rates used and then added. The total interest rate for the years specified in the loan is printed at the top of the screen.

As with fixed-rate mortgages, the program allows for considerable experimentation when dealing with adjustable mortgages. Figure 5 shows what occurs when the initial loan is reduced from $75,000 to $50,000 for the adjustable rates already specified.

Figure 5 about here

The examples so far shown really reflect quite favorably on adjustable rate mortgages. But this is where the plot thickens. There are many different ways of constructing adjustable mortgage rates, and one dandy way from a lender's viewpoint is not to have any caps. Assume that you have an ARM with an initial interest rate of 12 percent in the first year that increases to 20 percent in the ninth year. What happens to your monthly payments in this situation? By entering the interest rate as shown in Figure 6 you can see that the monthly payment increases from $771.46 a month in the first year to $1236.05 in the ninth year.

Figure 6 about here

The example in Figure 7 is even a little more drastic. Here the initial interest rate is 12 percent for the first three years, increases to 17.5 percent for the second three years, and then to 23 percent for the remainder of the loan. As can be seen, the monthly payment for the seventh and remaining years is $1,416.76.

Figure 7 about here

Rather than considering gloomy scenarios, data can be entered that reflect less than maximum increases or even decreases in interest rates. What is important is that the program allows one to experiment with different possibilities with respect to future ARM interest rates. There is no answer as to what type of mortgage is preferable. However, your Apple and this program should reduce some of the mystery surrounding adjustable rate mortgages.

How the Program Works.

The type of loan to be considered is entered in line 120. An entry of A indicates an adjustable mortgage and F signifies a fixed-rate mortgage. The amount of the loan is entered in line 220 and the value is stored in the variable AL. The term of the loan is entered in line 250 and the value stored in NY.

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Up to 10 different interest rates can be entered. Each interest rate is entered via line 370, first stored in YI\$, and then stored in the YI(C) array, where C can be a value from 1 to 10.

If fixed-interest rates are being considered, and T\$ is equal to F, the monthly payment for each of the interest rates specified is calculated in line 630:

630 PA = AL * (MI / (1 - (1 + MI) $\wedge$ - NP))

The variables in line 630 are as follows: PA = monthly payment, AL = the amount of the loan, MI = the interest for a monthly period (which is calculated in line 490), and NP = number of payments (which is calculated in line 270).

The total amount paid for a fixed-rate mortgage is determined in line 790:

790 T = INT (NP * PA * 100 + .5) / 100

The total amount is found by multiplying the number of payments (NP) by the amount of each payment (PA). The total interest paid is determined in the print statement in line 790 by subtracting the initial amount of the loan from the total amount paid or T - AL.

If the adjustable mortgage option is selected, monthly payments are calculated in line 630 until an adjustment in interest rates is made; that is, there is a difference between

interest rates for two given years. This is determined in line 520:

520 IF YI(C) = YI(C - 1) THEN 630

If the interest rates between any two years is different, the interest paid prior to that change is calculated in lines 580 and 590. Line 580 is used to calculate the balance of the loan still owed. The amount of interest paid for a given period having the same interest rate is then determined in line 590.

For adjustable loans, the number of payments to be made is determined in line 600. The variable CP signifies the number of years for a loan subperiod or the number of continuous years having the same interest rate. As an example, assume that in the fourth year the interest rate for an adjustable loan changes. Monthly payments are then calculated for the remaining principal or money owed after three years for a term of 27 years.

The output for adjustable loans is printed in line 800. Before the total interest is printed in line 1010, the interest for the remaining years of the loan is calculated in line 970. A variable decision is then entered in line 1050. If the value entered and stored in ND$ is equal to M, control is transferred to line 60 and the program begins anew; if ND$ is

equal to L, the loan amount (AL) variable in line 220 and
the number of years variable (NY) in line 250 can be redified;
if ND$ is equal to Y, only the number of years variavle is
redefined; if ND$ is equal to I, control is shifted to line
270 and new interest rates are entered; finally, if ND$ is
equal to d, control is transferred to line 1210 and the program
is terminated.

The major loop for calculating monthly payments and
total interest paid for each of the interest rates specified
begins in line 420 and extends to line 840:

                      420 FOR X = 1 TO NC

                      840 NEXT X

After the last interest rate to be c _sidered has been entered
and the .ETURN key is pressed, NC i et to the number of
variables entered (line 900). Each time loan information is
redefined, 1 to NC monthly payments are calculated.

Entering the Program and Modifications

When entering the program it is probably a good idea not
to enter the ONERR statement in line 50 until the program
has been debugged. Should a syntax or some other type of
error occur when entering the program, you will want to
kno exactly what the error is rather than have control shift
to another part of the program.

As was said before, there is no standard for calculating adjustable rate mortgages. Rather than having a cap on the maximum adjustment interest increase, there might be a cap on the maximum dollar amount increase. Thus, it is possible in this situation that the monthly payment does not pay the full interest due thereby resulting in negative amortization (the principal increases rather than decreases). Another possibility is that the term of the loan is increased after an adjustment in the interest rate is made. Whatever the case might be, modify the Loan and Mortgage Spreadsheet program so that it functions in accordance with the method for calculating adjustable rate mortgages in your area (a tip: give a call to the chief loan officer at your local bank).

Finally, when using the Loan and Mortgage Spreadsheet program remember that other variables might be a factor in deciding the best type of mortgage for a given situation. As an example, a bank might charge "points" for the privilege of obtaining a loan. If the points for a loan were 3 and the loan was for $50,000, then $1,500 would be paid at the time the loan is secured. Obviously a mortage with points might not be as good a buy as a mortgage from a different lender that did not chage points.

There does indeed seem an infinite number of ways that

a lender can separate you from your money. But armed with your Apple and Loan and Mortgage Spreadsheet program, you can minimize that separation as much as possible.
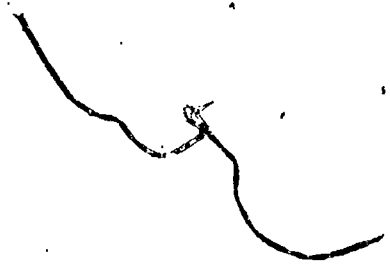
```
AMOUNT OF LOAN? 75000
NUMBER OF YEARS? 30

YEARLY INTEREST?

------------------------------------------

INTEREST   PAYMENTS   TOTAL INTEREST

14.125%    $896.08    $247588.6
14.24%     $903.52    $250265.52
14.375%    $910.96    $252946.05
14.5%      $918.42    $255630.1
14.575%    $922.89    $257242.19
14.755%    $933.66    $263702.57



M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST
ENTER M, L, Y OR I (E TO EXIT):
```

Figure 1

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```
AMOUNT OF LOAN? 75000
NUMBER OF YEARS? 20


------------------------------------------

INTEREST   PAYMENTS   TOTAL INTEREST

14.125%    $939.46    $150469.74
14.25%     $946.29    $152109.41
14.375%    $953.14    $153752.71
14.5%      $960       $155399.6
14.575%    $964.12    $156389.43
14.755%    $974.04    $158770.18
14.875%    $980.67    $160361.33


M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST
ENTER M, L, Y OR I (E TO EXIT):
```

Figure 2

```
AMOUNT OF LOAN? 50000
NUMBER OF YEARS? 30


-------------------------------------------

INTEREST   PAYMENTS   TOTAL INTEREST

 14.125%   $597.39    $165059.06
 14.25%    $602.34    $166843.68
 14.375%   $607.31    $168630.7
 14.5%     $612.28    $170420.07
 14.575%   $615.26    $171494.79
 14.755%   $622.44    $174077.43
 14.875%   $627.23    $175801.71


M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST
ENTER M, L, Y OR I (E TO EXIT):
```

Figure 3

```
AMOUNT OF LOAN? 75000
NUMBER OF YEARS? 30

TOTAL INTEREST = $276071.64

-----------------------------------

        INTEREST   YEAR    PAYMENTS

        12.75%       1     $815.02
        12.75%       2     $815.02
        12.75%       3     $815.02
        14.75%       4     $929.91
        14.75%       5     $929.91
        14.75%       6     $929.91
        16%          7     $1000.88


M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST
ENTER M, L, Y OR I (E TO EXIT):
```

Figure 4

```
AMOUNT OF LOAN? 50000
NUMBER OF YEARS? 30

TOTAL INTEREST = $184047.76

------------------------------------------

        INTEREST    YEAR    PAYMENTS

        12.75%        1     $543.35
        12.75%        2     $543.33
        12.75%        3     $543.35
        14.75%        4     $619.94
        14.75%        5     $619.94
        14.75%        6     $619.94
        16%           7     $667.25


M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST
ENTER M, L, Y OR I (E TO EXIT):
```

Figure 5

20

```
AMOUNT OF LOAN? 75000
NUMBER OF YEARS? 30

TOTAL INTEREST = $344853

-------------------------------------

     INTEREST    YEAR   PAYMENTS

       12%         1     $771.46
       13%         2     $829.05
       14%         3     $886.93
       15%         4     $944.99
       16%         5     $1003.18
       17%         6     $1061.44
       18%         7     $1119.7
       19%         8     $1177.92
       20%         9     $1236.05

M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST
ENTER M, L, Y OR I (E TO EXIT):
```

Figure 6

AMOUNT OF LOAN? 75000
NUMBER OF YEARS? 30

TOTAL INTEREST = $400050.76

INTEREST	YEAR	PAYMENTS
12%	1	$771.46
12%	2	$771.46
12%	3	$771.46
17.5%	4	$1090.28
17.5%	5	$1090.28
17.5%	6	$1090.28
23%	7	$1416.76

M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST
ENTER M, L, Y OR I (E TO EXIT):

Figure 7

```
10    REM    LOAN AND MORTGAGE SPREADSHEET
20    REM
30    REM    INPUT TYPE OF MORTGAGE
40    REM
50    ONERR  GOTO 1190
60    HOME : CLEAR
70    DIM YI(10)
80    FOR K = 1 TO 39:SP$ = SP$ + " ": NEXT K
90    VTAB 8: FOR K = 1 TO 39: PRINT "-";: NEXT K
100   PRINT
110   VTAB 1
120   INPUT "FIXED OR ADJUST. INTEREST (F OR A)? ";T$
130   IF T$ = "A" THEN 160
140   IF T$ = "F" THEN 210
150   GOTO 100
160   VTAB 1: PRINT SP$
170   VTAB 1: HTAB 12: FLASH : PRINT "ADJUSTABLE MORTGAGE": NORMAL
180   REM
190   REM    INPUT LOAN DATA
200   REM
210   VTAB 3
220   INPUT "AMOUNT OF LOAN? ";AL
230 LL = AL
240   VTAB 4: PRINT SP$: VTAB 4
250   INPUT "NUMBER OF YEARS? ";NY
260   VTAB 1: PRINT SP$
270 NP = NY * 12
280   IF ND$ = "Y" OR ND$ = "I" THEN AL = LL
290 C = 1:CP = 0
300   IF ND$ <  > "I" THEN 320
310 ND = 0: FOR K = 12 TO 22: VTAB K: PRINT SP$: NEXT K
320 CP = 0: VTAB 6: PRINT SP$
330   VTAB 6
340   IF ND < 1 THEN 360
350   GOTO 420
360 YI$ = ""
370   INPUT "YEARLY INTEREST? ";YI$
380 CP = CP + 1
390   IF YI$ = "" THEN 900
400 YI(C) =  VAL (YI$)
410   GOTO 490
420   FOR X = 1 TO NC
430   IF ND = 1 THEN CP = CP + 1
440   REM
450   REM    MI = INTEREST PER MONTH
460   REM    PA = MONTHLY PAYMENT
470   REM    T = TOTAL INTEREST AND PRINCIPAL PAID
480   REM
490 MI = YI(C) / 100 / 12
500   IF T$ = "F" THEN 630
```

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```
510   IF C = 1 THEN 630
520   IF YI(C) = YI(C - 1) THEN 630
530   REM
540   REM  CALCULATE MONTHLY PAYMENT
550   REM
560 PM = (CP - 1) * 12
570 PI = YI(C - 1) / 100 / 12
580   BA = PA * (1 - (1 + PI) ^ (PM - NP)) / PI
590 TI = TI + (CP - 1) * 12 * PA - (AL - BA)
600 NP = NP - (CP - 1) * 12
610 CP = 1
620 AL = BA
630 PA = AL * (MI / (1 - (1 + MI) ^  - NP))
640 RP =  INT (PA * 100 + .5) / 100
650   REM
660   REM  PRINT INTEREST RATES
670   REM
680   PRINT
690   IF T$ = "F" THEN 760
700   VTAB 10
710   PRINT  TAB( 7)"INTEREST    YEAR    PAYMENTS"
720   VTAB 11 + C: PRINT SP$
730   VTAB 11 + C
740   PRINT  TAB( 8);YI(C)"%" TAB( 19);C; TAB( 25)"$"RP
750   GOTO 810
760   VTAB 10
770   PRINT "INTEREST  PAYMENTS  TOTAL INTEREST"
780   VTAB 11 + C: PRINT SP$: VTAB 11 + C
790 T =  INT (NP * PA * 100 + .5) / 100
800   PRINT  TAB( 2);YI(C)"%" TAB( 11)"$"RP; TAB( 23)"$"T - AL
810 C = C + 1
820   IF C > 10 THEN 900
830   IF ND < 1 THEN 880
840   NEXT X
850 C = C - 1:CP = 0
860 CP = 0
870   GOTO 940
880   VTAB 6: HTAB 19: PRINT SP$: VTAB 6
890   GOTO 730
900 ND = 1:C = C - 1:NC = C:CP = 0
910   REM
920   REM  VARIABLE CONTROL DECISION
930   REM
940   FOR K = C TO 1 STEP  - 1
950   IF YI(K) <  > YI(K - 1) THEN 970
960 C = C - 1: NEXT K
970 TI = TI + (NY * 12 - (C - 1) * 12) * PA - AL
980 TI =  INT (TI * 100 + .5) / 100
990  IF T$ = "F" THEN 1020
1000  VTAB 6: PRINT SP$
```

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```
1010    VTAB 6: PRINT "TOTAL INTEREST = $"TI
1020 TI = 0
1030    VTAB 22
1040    PRINT "M=MORTGAGE, L=LOAN, Y=YEARS, I=INTEREST "
1050    VTAB 23: INPUT "ENTER M, L, Y OR I (E TO EXIT):";ND$
1060    VTAB 22: PRINT SP$: PRINT SP$
1070    IF ND$ = "M" THEN 60
1080    IF ND$ = "L" THEN 1130
1090    IF ND$ = "Y" THEN 240
1100    IF ND$ = "I" THEN 270
1110    IF ND$ = "E" THEN 1210
1120    GOTO 1030
1130    VTAB 1
1140  · FOR K = 1 TO 5: PRINT SP$: NEXT K
1150    GOTO 210
1160    REM
1170    REM   ERROR AND EXIT MESSAGES
1180    REM
1190    VTAB 22: INVERSE : PRINT "INPUT ERROR: PRESS 'RETURN' TO CONTINUE.":
        NORMAL
1200    GET E$: GOTO 1030
1210    VTAB 22: PRINT "THIS PROGRAM IS NOW OVER."
1220    END
```