CEG 2170
Programming Assignment 3

Purpose of Programming Assignment 3

The purpose of this assignment is to gain further experience with functions and conditional (if/else) statements, and gain new experience with loops. See the sample output for the expected results of your program.

General Requirements:

Write a C program that calculates the monthly payment and amortization schedule for a loan. The program should prompt the user to enter the loan amount, the annual interest rate, and the term of the loan (in years). Use the formula below to calculate the monthly payment. Note that the user input for interest rate and term will be in years, but you will need the *monthly* interest rate and term in *months* for this formula.

$$\textbf{\textit{Monthly Payment}} = \frac{rP}{1-(1+r)^{-n}}$$

where *P* is the principal (loan amount), *r* is the monthly interest rate, and *n* is the number of months

Required Functions:

main – prompt the user for the loan amount, annual interest rate, and the term of the loan in years. You are required to ensure loan amount and term are both greater than 0. You are required to ensure the annual interest rate is greater than 0 and less than or equal to 30. Use a while loop in each case to continuously prompt the user for a valid value until one is entered. Once all valid data is entered, call computeMonthlyPayment, then printLoanInfo, and then printTable. You are required to use a do/while loop around code that prompts the user to execute the loan analysis multiple times, each for a different loan, without the user having to re-run your program.

computeMonthlyPayment – accepts the loan amount, annual interest rate, and term of the loan in years. This function computes and returns the monthly payment.

computeMonthlyInterest – accepts the loan balance and annual interest rate. This function computes and returns the monthly interest.

printLoanInfo – accepts and prints the basic loan information; specifically the loan amount, monthly loan payment, annual interest rate, monthly interest rate, the term of the loan in years, the term of the loan in months, and the monthly loan payment. Compute whatever values are necessary in this function.

printTable – accepts the loan payment, the loan amount, the annual interest rate, and the loan term in years. This function prints the amortization table for the loan. Use a for loop to iterate over each month and compute and print the monthly loan information. Compute each column as follows:

- **interest for the month** = beginning monthly balance * monthly interest rate
- **principal payment** = loan balance – interest
- **new balance** = beginning balance – principal payment

Output:

Display all information as shown on the sample program runs that follow. The amortization table displays the loan balance at the beginning of each month, the monthly payment, the interest for the month, the principal payment, and the new balance. There should be an output line for each month over the life of the loan. For example, if a loan is for 5 years, there will be 60 lines of output.

Display all currency with two places to the right of the decimal; display all interest rate values with three places to the right of the decimal.

Part 2 – Sample Program Interaction

```
Enter loan amount: 15000

Enter interest rate: 0

ERROR: Invalid rate; must be > 0.0 and <= 30.0.

Enter interest rate: 31

ERROR: Invalid rate; must be > 0.0 and <= 30.0.

Enter interest rate: 3.25

Enter term in years: 5


LOAN INFORMATION
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Initial loan amount:    15000.00
Annual interest rate:   0.271%
Monthly interest rate:  0.023%
Term of loan (years):   5
Term of loan (months):  60
Monthly payment amount: $271.20
```

Month	Old Balance	Monthly Payment	Interest Paid	Principal Paid	New Balance
1	$ 15000.00	$ 271.20	$ 40.62	$ 230.58	$ 14769.42
2	$ 14769.42	$ 271.20	$ 40.00	$ 231.20	$ 14538.23
3	$ 14538.23	$ 271.20	$ 39.37	$ 231.83	$ 14306.40
4	$ 14306.40	$ 271.20	$ 38.75	$ 232.45	$ 14073.95
5	$ 14073.95	$ 271.20	$ 38.12	$ 233.08	$ 13840.86
6	$ 13840.86	$ 271.20	$ 37.49	$ 233.71	$ 13607.15
7	$ 13607.15	$ 271.20	$ 36.85	$ 234.35	$ 13372.80
8	$ 13372.80	$ 271.20	$ 36.22	$ 234.98	$ 13137.82
9	$ 13137.82	$ 271.20	$ 35.58	$ 235.62	$ 12902.20
10	$ 12902.20	$ 271.20	$ 34.94	$ 236.26	$ 12665.94
11	$ 12665.94	$ 271.20	$ 34.30	$ 236.90	$ 12429.05
12	$ 12429.05	$ 271.20	$ 33.66	$ 237.54	$ 12191.51
13	$ 12191.51	$ 271.20	$ 33.02	$ 238.18	$ 11953.33
14	$ 11953.33	$ 271.20	$ 32.37	$ 238.83	$ 11714.50
15	$ 11714.50	$ 271.20	$ 31.73	$ 239.47	$ 11475.03
16	$ 11475.03	$ 271.20	$ 31.08	$ 240.12	$ 11234.91
17	$ 11234.91	$ 271.20	$ 30.43	$ 240.77	$ 10994.13
18	$ 10994.13	$ 271.20	$ 29.78	$ 241.42	$ 10752.71
19	$ 10752.71	$ 271.20	$ 29.12	$ 242.08	$ 10510.63
20	$ 10510.63	$ 271.20	$ 28.47	$ 242.73	$ 10267.90
21	$ 10267.90	$ 271.20	$ 27.81	$ 243.39	$ 10024.51
22	$ 10024.51	$ 271.20	$ 27.15	$ 244.05	$ 9780.46
23	$ 9780.46	$ 271.20	$ 26.49	$ 244.71	$ 9535.75
24	$ 9535.75	$ 271.20	$ 25.83	$ 245.37	$ 9290.37
25	$ 9290.37	$ 271.20	$ 25.16	$ 246.04	$ 9044.33
26	$ 9044.33	$ 271.20	$ 24.50	$ 246.70	$ 8797.63
27	$ 8797.63	$ 271.20	$ 23.83	$ 247.37	$ 8550.25
28	$ 8550.25	$ 271.20	$ 23.16	$ 248.04	$ 8302.21

29	$ 8302.21	$ 271.20	$ 22.49	$ 248.71	$ 8053.50
30	$ 8053.50	$ 271.20	$ 21.81	$ 249.39	$ 7804.11
31	$ 7804.11	$ 271.20	$ 21.14	$ 250.06	$ 7554.04
32	$ 7554.04	$ 271.20	$ 20.46	$ 250.74	$ 7303.30
33	$ 7303.30	$ 271.20	$ 19.78	$ 251.42	$ 7051.88
34	$ 7051.88	$ 271.20	$ 19.10	$ 252.10	$ 6799.78
35	$ 6799.78	$ 271.20	$ 18.42	$ 252.78	$ 6547.00
36	$ 6547.00	$ 271.20	$ 17.73	$ 253.47	$ 6293.53
37	$ 6293.53	$ 271.20	$ 17.04	$ 254.16	$ 6039.37
38	$ 6039.37	$ 271.20	$ 16.36	$ 254.84	$ 5784.53
39	$ 5784.53	$ 271.20	$ 15.67	$ 255.53	$ 5529.00
40	$ 5529.00	$ 271.20	$ 14.97	$ 256.23	$ 5272.77
41	$ 5272.77	$ 271.20	$ 14.28	$ 256.92	$ 5015.85
42	$ 5015.85	$ 271.20	$ 13.58	$ 257.62	$ 4758.24
43	$ 4758.24	$ 271.20	$ 12.89	$ 258.31	$ 4499.92
44	$ 4499.92	$ 271.20	$ 12.19	$ 259.01	$ 4240.91
45	$ 4240.91	$ 271.20	$ 11.49	$ 259.71	$ 3981.20
46	$ 3981.20	$ 271.20	$ 10.78	$ 260.42	$ 3720.78
47	$ 3720.78	$ 271.20	$ 10.08	$ 261.12	$ 3459.65
48	$ 3459.65	$ 271.20	$ 9.37	$ 261.83	$ 3197.82
49	$ 3197.82	$ 271.20	$ 8.66	$ 262.54	$ 2935.29
50	$ 2935.29	$ 271.20	$ 7.95	$ 263.25	$ 2672.04
51	$ 2672.04	$ 271.20	$ 7.24	$ 263.96	$ 2408.07
52	$ 2408.07	$ 271.20	$ 6.52	$ 264.68	$ 2143.39
53	$ 2143.39	$ 271.20	$ 5.81	$ 265.40	$ 1878.00
54	$ 1878.00	$ 271.20	$ 5.09	$ 266.11	$ 1611.88
55	$ 1611.88	$ 271.20	$ 4.37	$ 266.83	$ 1345.05
56	$ 1345.05	$ 271.20	$ 3.64	$ 267.56	$ 1077.49
57	$ 1077.49	$ 271.20	$ 2.92	$ 268.28	$ 809.21
58	$ 809.21	$ 271.20	$ 2.19	$ 269.01	$ 540.20
59	$ 540.20	$ 271.20	$ 1.46	$ 269.74	$ 270.47
60	$ 270.47	$ 270.47	$ 0.73	$ 269.74	$ 0.73

Total Interest Paid: $1272.00

Would you like to process another loan (Y/N): y

Enter loan amount: 5000

Enter interest rate: 5.5

Enter term in years: 2

LOAN INFORMATION

Initial loan amount: 5000.00
Annual interest rate: 0.458%
Monthly interest rate: 0.038%
Term of loan (years): 2
Term of loan (months): 24
Monthly payment amount: $220.48

Month	Old Balance	Monthly Payment	Interest Paid	Principal Paid	New Balance
1	$ 5000.00	$ 220.48	$ 22.92	$ 197.56	$ 4802.44
2	$ 4802.44	$ 220.48	$ 22.01	$ 198.47	$ 4603.97
3	$ 4603.97	$ 220.48	$ 21.10	$ 199.38	$ 4404.59
4	$ 4404.59	$ 220.48	$ 20.19	$ 200.29	$ 4204.30
5	$ 4204.30	$ 220.48	$ 19.27	$ 201.21	$ 4003.10
6	$ 4003.10	$ 220.48	$ 18.35	$ 202.13	$ 3800.96
7	$ 3800.96	$ 220.48	$ 17.42	$ 203.06	$ 3597.91
8	$ 3597.91	$ 220.48	$ 16.49	$ 203.99	$ 3393.92
9	$ 3393.92	$ 220.48	$ 15.56	$ 204.92	$ 3189.00
10	$ 3189.00	$ 220.48	$ 14.62	$ 205.86	$ 2983.13
11	$ 2983.13	$ 220.48	$ 13.67	$ 206.81	$ 2776.33
12	$ 2776.33	$ 220.48	$ 12.72	$ 207.75	$ 2568.58
13	$ 2568.58	$ 220.48	$ 11.77	$ 208.71	$ 2359.87
14	$ 2359.87	$ 220.48	$ 10.82	$ 209.66	$ 2150.21

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15   $     2150.21  $   220.48  $     9.86  $   210.62   $  1939.58
16   $     1939.58  $   220.48  $     8.89  $   211.59   $  1728.00
17   $     1728.00  $   220.48  $     7.92  $   212.56   $  1515.44
18   $     1515.44  $   220.48  $     6.95  $   213.53   $  1301.91
19   $     1301.91  $   220.48  $     5.97  $   214.51   $  1087.39
20   $     1087.39  $   220.48  $     4.98  $   215.49   $   871.90
21   $      871.90  $   220.48  $     4.00  $   216.48   $   655.42
22   $      655.42  $   220.48  $     3.00  $   217.47   $   437.94
23   $      437.94  $   220.48  $     2.01  $   218.47   $   219.47
24   $      219.47  $   219.47  $     1.01  $   218.47   $     1.00

Total Interest Paid: $291.48


Would you like to process another loan (Y/N): N

Process returned 0 (0x0)   execution time : 90.380 s
Press any key to continue.
```

What to Turn In

Upload your zipped (compressed) project to the Dropbox on Pilot. Be sure your program follows the guidelines given on the Style Requirements document (provided on Pilot) with respect to commenting, variable naming, indenting, etc.

Grading Rubric

General documentation/style (25 points possible; add all that apply)
Complete header information at top of program (5 pts)
Meaningful variable names (3 pts)
Correct indenting (3 points)
Correct use of white space; in general, code is single-spaced with a blank line between sections (such as between variable declarations and input; between input and calculations; between calculations and output). This applies to main and all other functions (3 pts)
Calculation results are stored in variables; calculations are NOT performed within a print statement (3 pts)
Functions are meaningfully named; all functions names contain a verb (3 pts)
All functions are declared before the main function, and are implemented after the main function (5 points)
Function to calculate monthly payment (10 pts; add all that apply)
Appropriate parameter list (input parameters only) and return type (3 pts)
Correctly calculates and returns the monthly payment (5 pts)
Complete documentation (comment above function explaining its purpose, listing input parameters, and describing the return if applicable) (2 pts)
Function to calculate display amortization table (25 pts; add all that apply)
Appropriate parameter list (input parameters only) and return type (3 pts)
Displays the initial loan amount, interest rates, terms, and payment as shown in the sample program run (2 pts)
Column headings are displayed and well-aligned (3 pts)
Correctly calls the function to compute the monthly interest (2 pts)
Correctly calculates principal paid and new monthly balance (5 pts)
Correctly and neatly displays the table for the correct number of months (5 pts)
Adjusts final payment to avoid negative final balance (3 pts)
Complete documentation (comment above function explaining its purpose, listing input parameters, and describing the return if applicable) (2 pts)
Function to calculate monthly interest (10 pts; add all that apply)
Appropriate parameter list (input parameters only) and return type (3 pts)
Correctly calculates and returns monthly interest amount (5 points)
Complete documentation (comment above function explaining its purpose, listing input parameters, and describing the return if applicable) (2 pts)
Main method (30 points possible; add all that apply):
Correct declaration of variables; no unused-variables are declared (4 pts)
Correctly gathers user input (principal, annual interest rate, and term of loan in years only), with user-friendly prompts (8 pts)
Correctly calls functions to calculate monthly payment and print amortization table (8 pts)
Does only the tasks specified on the previous lines; no other input, calculations, or printing are done from within the main function (10 points -- no partial credit given)