

DATA 200

Computational Programming for Analytics

Section 21
Spring 2024
Instructor: Ron Mak

Assignment #2

Assigned: Thursday, February 8
Due: Thursday, February 15 at 5:30 pm
100 points max

IF statements and loops

Create and submit a Jupyter notebook containing Python code that solves the following problems. You can create a separate notebook for each problem. Then zip the notebooks together and submit the zip file.

Square root table

PROBLEM 1: Create a square root table with 26 rows and 10 columns. Including the row and column headers, rows 0 through 5 and row 25 should look like this:

	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9
0	0.0000	0.3162	0.4472	0.5477	0.6325	0.7071	0.7746	0.8367	0.8944	0.9487
1	1.0000	1.0488	1.0954	1.1402	1.1832	1.2247	1.2649	1.3038	1.3416	1.3784
2	1.4142	1.4491	1.4832	1.5166	1.5492	1.5811	1.6125	1.6432	1.6733	1.7029
3	1.7321	1.7607	1.7889	1.8166	1.8439	1.8708	1.8974	1.9235	1.9494	1.9748
4	2.0000	2.0248	2.0494	2.0736	2.0976	2.1213	2.1448	2.1679	2.1909	2.2136
5	2.2361	2.2583	2.2804	2.3022	2.3238	2.3452	2.3664	2.3875	2.4083	2.4290
...										
25	5.0000	5.0100	5.0200	5.0299	5.0398	5.0498	5.0596	5.0695	5.0794	5.0892

For example, this says that the square root of 2.0 is 1.4142, the square root of 4.0 is 2.0000, and the square root of 4.5 is 2.1213

Import the `math` package and use the `math.sqrt()` function.

Simple bar chart

PROBLEM 2: Import the `random` package. Then to simulate rolling a fair die, each call of the function `random.randrange(1, 7)` will return one of the face values 1 through 6 inclusive, each value with equal probability.

Call `random.randrange(1, 7)` one hundred times and count how many times each value is returned. Then write code to print a simple bar chart of the frequencies. For example, it should look something like this:

```
1: (18) *****
2: (11) *****
3: (17) *****
4: (17) *****
5: (15) *****
6: (22) *****
```

For each face value, print its count in parentheses and then that number of stars. Your bar chart will be different, of course, since the values are random.

TIP: First set six variables to 0:

```
ones = twos = threes = fours = fives = sixes = 0
```

Then as each random value is returned, increment the appropriate variable by 1. After your code has generated one hundred random values, the variables will contain the frequencies of the face values.

Integer to Roman numeral converter

PROBLEM 3: Write Python code to convert a positive integer value to its equivalent in Roman numerals. For example, 1999 is MCMXCIX.

For a refresher on Roman numerals, see https://en.wikipedia.org/wiki/Roman_numerals. Read up to but not including the section “Other forms”.

Your code should repeatedly prompt the user for an integer value, convert it, and then print both the integer value and its Roman numeral equivalent. If the user inputs a negative value or a value greater than 3999, print an error

How to read Roman Numerals

1. A letter repeats its value that many times
(XXX = 10+10+10 = 30, CC = 100 + 100 = 200, etc.).
A letter can only be repeated three times.
2. If one or more letters are placed after another letter of greater value, add that amount.
VI = 6 (5 + 1 = 6)
LXX = 70 (50 + 10 + 10 = 70)
MCC = 1200 (1000 + 100 + 100 = 1200)
3. If a letter is placed before another letter of greater value, subtract that amount.
IV = 4 (5 - 1 = 4)
XC = 90 (100 - 10 = 90)
CM = 900 (1000 - 100 = 900)



message and prompt the user for another value. Your code should end when the user inputs 0.

Test your code by inputting these values one at a time:

1 3 4 5 8 9 13 -21 49 88 999 1492 1969 2001 4096 2024 0

Your output should look something like this:

```
Integer value? 1
  1 is I

Integer value? 3
  3 is III

Integer value? 4
  4 is IV

Integer value? 5
  5 is V

Integer value? 8
  8 is VIII

Integer value? 9
  9 is IX

Integer value? 13
  13 is XIII

Integer value? -21
  -21 is negative. Try again.

Integer value? 49
  49 is XLIX

Integer value? 88
  88 is LXXXVIII

Integer value? 999
  999 is CMXCIX

Integer value? 1492
  1492 is MCDXCII

Integer value? 1969
  1969 is MCMLXIX

Integer value? 2001
  2001 is MMI

Integer value? 4096
  4096 is too big. Try again.

Integer value? 2024
  2024 is MMXXIV

Integer value? 0
Done!
```

Integer	Roman
1000	M
900	CM
500	D
400	CD
100	C
90	XC
50	L
40	XL
10	X
9	IX
5	V
4	IV
1	I

TIP: Generate a Roman numeral by repeatedly subtracting from the integer value while printing the appropriate Roman character(s) in this order: 1000s (M), 900 (CM), 500 (D), 400 (CD), 100s (C), etc.

For example, for each 1000 you can subtract from the integer value, print an M.

What to submit

Submit your Jupyter notebook. If there are several notebooks, zip them together and submit the zip file.

Rubric

Criteria	Max points
Square root table <ul style="list-style-type: none">• Correct values in the table.• Table formatted correctly.• Code uses loops correctly.	30 <ul style="list-style-type: none">• 10• 10• 10
Simple bar chart <ul style="list-style-type: none">• Random face values generated correctly.• Frequency counts computed correctly.• Bar chart generated and printed correctly.	30 <ul style="list-style-type: none">• 10• 10• 10
Integer to Roman numeral converter <ul style="list-style-type: none">• Input values prompted for and checked.• Conversions done and printed correctly.• Good use of if statements and loops.	40 <ul style="list-style-type: none">• 10• 20• 10