

ITS100 Lab Midterm Quiz 2/2022

Q1

Write a program that calculates the circle area given its diameter and the desired units for the input diameter and output area. The program takes three inputs:

- The diameter of the circle.
- The units of the diameter (e.g., centimeters, inches, millimeters).
- The units for the output area (e.g., square centimeters, square inches, square millimeters).

Then, the program returns the area of the circle in the specified output units. The program must support the following units, "cm" (centimeters), "in" (inches), and "mm" (millimeters). Note that 1 inch is equal to 25.4 mm. If the input of the diameter value is not positive or the unit inputs do not match the support units, the program must output "Invalid input". An area of a circle formula is $A = \pi r^2$, where A is the area and r is the radius.

The program displays all numbers with exactly two decimal places. The program is formatted the same as in the examples below.

Example 1 (user inputs are in *italics*)

```
Input a circle diameter: 10.5
Input a unit of the diameter: cm
Input a unit of the output area: in
The surface of a circle with a 10.50 cm diameter is 13.42 square in.
```

Example 2 (user inputs are in *italics*)

```
Input a circle diameter: 1
Input a unit of the diameter: in
Input a unit of the output area: mm
The surface of a circle with a 1.00 in diameter is 506.71 square mm.
```

Example 3 (user inputs are in *italics*)

```
Input a circle diameter: 0
Input a unit of the diameter: in
Input a unit of the output area: cm
Invalid input
```

Example 4 (user inputs are in *italics*)

```
Input a circle diameter: 101.5
Input a unit of the diameter: mm
Input a unit of the output area: cm
The surface of a circle with a 101.50 mm diameter is 80.91 square cm.
```

Example 5 (user inputs are in *italics*)

```
Input a circle diameter: 90
Input a unit of the diameter: CM
Input a unit of the output area: mm
Invalid input
```

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Q2

If you borrow x monetary units from a bank whose annual interest rate is $y\%$, then after one year you need to repay $p = x \cdot (1 + y/100)$ units to clear the loan (for example, $x=100$, $y=5$, then $p=105$). If you repay some smaller amount $q < p$, then you still owe the bank $p-q$ and hence after one more year, you need to repay $(p-q) \cdot (1 + y/100)$, and so on.

Write a program to help the bank to compute how much a customer needs to repay at the end of last year to clear a multi-year loan. The program asks the borrowed amount, duration (in years) and annual interest rate, as exemplified by the following examples.

Example 1 (user inputs are in *italics*)

Input: borrowed amount, duration(years), annual interest(%) *100 1 5*
Output: To clear your loan, you need to repay 105.0 at the end of year 1

Example 2 (user inputs are in *italics*)

Input: borrowed amount, duration(years), annual interest(%) *1000 2 5*
Input: pay at the end of year 1 *500*
Output: To clear your loan, you need to repay 577.5 at the end of year 2

Example 3 (user inputs are in *italics*)

Input: borrowed amount, duration(years), annual interest(%) *1000 3 5*
Input: pay at the end of year 1 *200*
Input: pay at the end of year 2 *300*
Output: To clear your loan, you need to repay 622.125 at the end of year 3

Example 4 (user inputs are in *italics*)

Input: borrowed amount, duration(years), annual interest(%) *100 2 5*
Input: pay at the end of year 1 *200*
Output: You already clear your loan

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Q3

Write a program that determines the sphere radius length given its volume and the desired units for the input volume and output length. The program takes three inputs.

- The volume of a sphere.
- The units of the volume (e.g., cubic foot, cubic inches).
- The units for the output radius length (e.g., cubic foot, cubic inches).

Then, the program returns the sphere radius length in the specified output units. The program must support the following units, "ft" (feet) and "in" (inches). Note that 1 foot is equal to 12 inches. If the input of the sphere volume is not positive or the unit inputs do not match the support units, the program must output "Invalid input". The $\sqrt[3]{x}$ is equivalent to $x^{1/3}$. A sphere volume formula is $V = \frac{4}{3}\pi r^3$, where V is the volume and r is the radius.

The program displays all numbers with exactly two decimal places. The program is formatted the same as in the examples below.

Example 1 (user inputs are in *italics*)

```
Input a sphere volume: 10.5
Input a unit of the volume: ft
Input a unit of the sphere radius length: in
The radius of a sphere with a volume of 10.50 cubic ft is 16.30 in.
```

Example 2 (user inputs are in *italics*)

```
Input a sphere volume: 90.4
Input a unit of the volume: in
Input a unit of the sphere radius length: ft
The radius of a sphere with a volume of 90.40 cubic in is 0.23 ft.
```

Example 3 (user inputs are in *italics*)

```
Input a sphere volume: 5.5
Input a unit of the volume: ft
Input a unit of the sphere radius length: ft
The radius of a sphere with a volume of 5.50 cubic ft is 1.10 ft.
```

Example 4 (user inputs are in *italics*)

```
Input a sphere volume: 0
Input a unit of the volume: ft
Input a unit of the sphere radius length: ft
Invalid input
```

Example 5 (user inputs are in *italics*)

```
Input a sphere volume: 10
Input a unit of the volume: in
Input a unit of the sphere radius length: FT
Invalid input
```

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Q4

Write a program that takes two integers, w and h , as inputs where w is the width and h is the height of the square—the program output is as follows.

- Odd number lines print increasing numbers, and even number lines print decreasing numbers.
- The start numbers of each line are increased.
- The program must output “Invalid input” when w and h is not positive number.
- The program must output “Invalid input” when the values of w and h are not between 1 and 9.
-

Example 0 (user inputs are in *italics*)

```
Input: 5 -1
Invalid input
```

Example 1 (user inputs are in *italics*)

```
Input: 5 1
12345
```

Example 2 (user inputs are in *italics*)

```
Input: 4 3
1234
4321
2341
```

Example 3 (user inputs are in *italics*)

```
Input: 6 6
123456
654321
234561
543216
345612
432165
```

Example 4 (user inputs are in *italics*)

```
Input: sang -1
Invalid input
```

Example 5 (user inputs are in *italics*)

```
Input: 10 1
Invalid input
```