Beni-Suef University

Faculty of Computers and Artificial Intelligence

First Term 2021/2022

CS 241 - Object Oriented Programming

SHEET #1

1. Assume that a runner runs 24 miles in 1 hour, 40 minutes, and 35 seconds. Write a program that displays the average speed in kilometers per hour. (Note 1 mile is equal to 1.6 kilometers.)

2. Write a program that reads in the length of sides of an equilateral triangle and computes the area and volume using the following formulas:

   area = $\frac{\sqrt{3}}{4}$ (length of sides)^2

   volume = area * length

   Note you can use Math. pow(a, 0.5) to compute $\sqrt{a}$.

   Here is a sample run:

```
Enter length of the sides and height of the Equilateral
triangle: 3.5 ↵Enter
The area is 3.89
The volume of the Triangular prism is 19.48
```

3. Write a program that reads the subtotal and the gratuity rate and then computes the gratuity and total. For example, if the user enters 10 for subtotal and 12% for gratuity rate, the program displays $1.2 as gratuity and $11.2 as total.

4. Write a program that reads an integer between 0 and 1000 and multiplies all the digits in the integer. For example, if an integer is 932, the multiplication of all its digits is 54.

5. Write a program that prompts the user to enter the minutes (e.g., 1 billion), and displays the number of years and remaining days for the minutes. For simplicity, assume that a year has 365 days.

6. Body Mass Index (BMI) is a measure of health on weight. It can be calculated by taking your weight in kilograms and dividing, by the square of your height in meters. Write a program that prompts the user to enter a weight in pounds and height in inches and displays the BMI. Note one pound is 0.45359237 kilograms and one inch is 0.0254 meters.

7. Write a program that prompts the user to enter two points (x1, y1) and (x2, y2) and displays their distance.

   The formula for computing the distance is:

$$\sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

8. Write a program that reads in investment amount, annual interest rate, and number of years, and displays the future investment value using the following formula: and displays the future investment value using the following formula:
   futureInvestmentValue = investmentAmount * (1 + monthlyInterestRate)^{numberOfYears*12}
   For example, if you enter amount 1000, annual interest rate 3.25%, and number of years 1, the future investment value is 1032.98.

9. Write a program to teach a first-grade child how to learn subtractions. The program **randomly** generates two single-digit integers number1 and number2 with number1 >= number2 and displays a question such as "What is 9 – 2?" to the student. After the student types the answer, the program displays whether the answer is correct.
   Note: you can use (Math.random() *10) to generate a random number between 0 and 10.

10. Write a program that randomly generates an integer between 1 and 12 and displays the English month names January, February, . . . , December for the numbers 1, 2, . . . , 12, accordingly.

11. Body Mass Index (BMI) is a measure of health on weight. It can be calculated by taking your weight in kilograms and dividing by the square of your height in meters. The interpretation of BMI for people 16 years or older is as follows:

BMI	Interpretation
BMI < 18.5	Underweight
18.5 <= BMI < 25.0	Normal
25.0 <= BMI < 30.0	Overweight
30.0 <= BMI	Obese

   Write a program to compute the BMI measure, the program let the user enters his weight in pounds and his height in inches. Here is a sample run

```
Enter weight in pounds: 140 Enter
Enter inches: 10 Enter
BMI is 20.087702275404553
Normal
```

Note:
Kilograms per pound = 0.45359237 and
Meters per inch = 0.0254.

12. Write a program that prompts the user to enter three integers and display the integers in an increasing order (sort three numbers).

13. Write a program that prompts the user to enter a three-digit integer and determines whether it is a palindrome integer. An integer is palindrome if it reads the same from right to left and from left to right. A negative integer is treated the same as a positive integer. Here are sample runs of this program:

```
Enter a three-digit integer: 121 Enter
121 is a palindrome
```

```
Enter a three-digit integer: 123 Enter
123 is not a palindrome
```

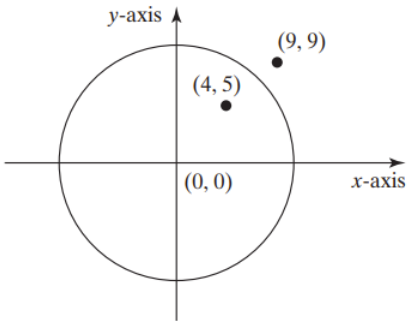
14. A shipping company uses the following function to calculate the cost (in dollars) of shipping based on the weight of the package (in pounds).

$$c(w) = \begin{cases} 2.5, \text{if } 0 < w <= 2 \\ 4.5, \text{if } 2 < w <= 4 \\ 7.5, \text{if } 4 < w <= 10 \\ 10.5, \text{if } 10 < w <= 20 \end{cases}$$

Write a program that prompts the user to enter the weight of the package and display the shipping cost. If the weight is greater than 20, display a message "the package cannot be shipped."

15. Write a program that reads three edges for a triangle and computes the perimeter if the input is valid. Otherwise, display that the input is invalid. The input is valid if the sum of every pair of two edges is greater than the remaining edge.

16. Write a program that prompts the user to enter a point (x, y) and checks whether the point is within the circle centered at (0, 0) with radius 10. For example, (4, 5) is inside the circle and (9, 9) is outside the circle, as shown in the figure.



A point is in the circle if its distance to (0, 0) is less than or equal to 10. Use the formula in ***question 7*** to compute the distance between the two points.

17. Write a program to determine if a year is a leap year or not. This program prompts the user to enter a year as an int value and checks if it is a leap year.

Note: A year is a leap year if it is divisible by 4 but not by 100, or it is divisible by 400.

18. Write a program that prompts the user to enter an integer and determines whether it is divisible by 4 and 5, whether it is divisible by 4 or 5, and whether it is divisible by 4 or 5 but not both. Here is a sample run of this program:

```
Enter an integer: 10 Enter
Is 10 divisible by 4 and 5? false
Is 10 divisible by 4 or 5? true
Is 10 divisible by 4 or 5 but not both? true
```

19. The US federal personal income tax is calculated based on the filing status and taxable income. There are four filing statuses: single filers, married filing jointly, married filing separately, and head of household. The tax rates for 2020 are shown below:

Marginal Tax Rate	*Single*	*Married Filing Jointly or Qualifying Widow(er)*	*Married Filing Separately*	*Head of Household*
10%	$0 – $8,350	$0 – $16,700	$0 – $8,350	$0 – $11,950
15%	$8,351 – $33,950	$16,701 – $67,900	$8,351 – $33,950	$11,951 – $45,500
25%	$33,951 – $82,250	$67,901 – $137,050	$33,951 – $68,525	$45,501 – $117,450
28%	$82,251 – $171,550	$137,051 – $208,850	$68,526 – $104,425	$117,451 – $190,200
33%	$171,551 – $372,950	$208,851 – $372,950	$104,426 – $186,475	$190,201 – $372,950
35%	$372,951+	$372,951+	$186,476+	$372,951+

Write a program to compute personal income tax. Your program should prompt the user to enter the filing status and taxable income and compute the tax.

Here is a sample run of this program:

```
0-single filer,
1-married jointly or qualifying widow(er),
2-married separately,
3-head of household)
Enter the filing status: 0
Enter the taxable income: 100000
Tax is 21720.0
```

20. Zeller's congruence is an algorithm developed by Christian Zeller to calculate the day of the week. The formula is

$$h = \left(q + \frac{26(m+1)}{10} + k + \frac{k}{4} + \frac{j}{4} + 5j\right)\%7$$

Where:

- h is the day of the week (0: Saturday, 1: Sunday, 2: Monday, 3: Tuesday, 4: Wednesday, 5: Thursday, and 6: Friday).
- q is the day of the month.
- m is the month (3: March, 4: April, . . ., 12: December). January and February are counted as months 13 and 14 of the previous year.
- j is $\frac{year}{100}$.
- k is the year of the century (i.e., year % 100).

Write a program that prompts the user to enter a year, month, and day of the month, and displays the name of the day of the week. Here are some sample runs:

```
Enter year: (e.g., 2012): 2015 Enter
Enter month: 1-12: 1 Enter
Enter the day of the month: 1-31: 25 Enter
Day of the week is Sunday
```

Note all divisions in this exercise perform an integer division.

Best Wishes
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