Introduction to programming 1

Lab 4: Selection - Making decisions; Repetitions

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1. Write a program that determines a student's grade. It reads three test scores (between 0 and 100) and calculates the student's grade based on the following rules.
   a. If the average score is 90% or more, the grade is **A**.
   b. If the average score is 70% or more and less than 90%, it checks the third score. If the third score is more than 90%, the grade is A; otherwise, the grade is **B**.
   c. If the average score is 50% or more and less than 70%, it checks the average of the second and third score. If the average of the two is greater than 70%, the grade is **C**; otherwise, it is **D**.
   d. If the average score is less than 50%, then the grade is F.

2. Consider a 2D coordinate system. Write a program to calculate the slope of the given line segment joining the two points. Handle the special cases for the slope of the horizontal and vertical lines.

3. Write a program that ask the user to enter the current date and a person's birth date in the form month, day, year. The program then calculate the person's age in integral years.

4. Write a program to calculate the parking fare for customers who park their cars in a parking lot when the following information is given:
   a. A character showing the type of vehicle: **C** for car, **B** for bus, **T** for truck.
   b. An integer between 0 and 24 showing the hour the vehicle entered the lot
   c. An integer between 0 and 60 showing the minute the vehicle entered the lot
   d. An integer between 0 and 24 showing the hour the vehicle left the lot
   e. An integer between 0 and 60 showing the minute the vehicle left the lot
   This is a public lot. To encourage people to park for a short period of time, the management uses two different rates for each type of vehicle as shown in the following table.

Vehicle	First Rate	Second Rate
Car	$0.00/hr first 3 hr	$1.50/hr after 3hr
Truck	$1.00/hr first 2 hr	$2.30/hr after 2hr
Bus	$2.00/hr for first hr	$3.70/hr after first hr

No vehicle is allowed to stay in the parking lot later than midnight. Violation may lead to tow the vehicle away.

The input data consists of a character and a set of 4 integers representing the type of vehicle and the entering and leaving time of the vehicle as stated in the beginning of the question. These pieces of data must be input to the computer in a user-friendly way with proper prompt as below:

```
Type of vehicle? C
Hour vehicle entered the lot (0 - 24)? 14
Minute vehicle entered the lot (0 - 60)? 23
Hour vehicle left the lot (0 - 24)? 18
Minute vehicle left the lot (0 - 60)?8
```

The output format is shown below:

```
                    PARKING LOT CHARGE

        Type of vehicle: Car or Bus or Truck
        TIME-IN                 XX : XX
        TIME-OUT                XX : XX
                               _____

        PARKING TIME            XX : XX
        ROUNDED TOTAL                XX
                               _____

        TOTAL CHARGE         $XXX : XX
```

5. Write a program for a guessing game. The computer is to generate a random number between 1 and 20. The user will be given up to five tries to guess the exact number. After each guess, the program will tell the user if the guessed number is greater than, less than, or equal to the random number. If it is equal, no more guesses should be made. If the user is unable to guess the number after five tries, display the number with a message that the user should know it by now and terminate the game.

   A possible interaction of the game for successful attempt may look like this

```
I am thinking of a number between 1 and 20.
Can you guess what it is? 10
Your guess is low. Try again: 15
Your guess is low. Try again: 17
Your guess is high. Try again: 16

Congratulations!! You did it :)
```

   A possible unsuccessful dialogue may be:

```
I am thinking of a number between 1 and 20.
Can you guess what it is? 10
Your guess is low. Try again: 20
Your guess is high. Try again: 10
Your guess is low. Try again: 18
Your guess is high. Try again: 12

Sorry.. :( The Number was 15.
You should have gotten it by now.
Better luck next time..
```

6. Write a menu driven program that allows the user to enter five numbers and then choose between finding the smallest, largest, sum, or average. Use a switch statement to determine what action to take. Provide an error message if an invalid choice is entered.

7. Write a program to compute the real roots of a quadratic equation $a x^2 + bx + c$

The roots can be calculates using the following formula

$$x_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \qquad \text{and} \qquad x_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$
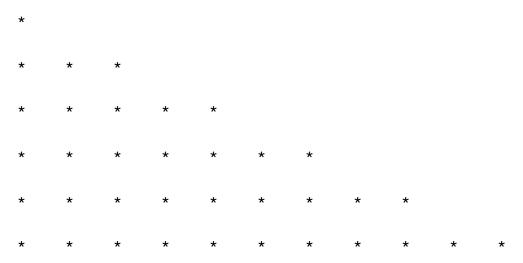
The program will prompt the user to enter the constants (a, b, c). Its will then display the roots based on the following rules.

    a. If both a and b are zero, there is no solution.

    b. If a is zero, there is only one root $\frac{-c}{b}$.

    c. If the discriminate $b^2 - 4ac$ is negative, there is no real root.

    d. For all other combination, there are two roots.

8. Write a program that ask the user to enter a list of integers. The program is to determine the largest value entered and the number of times it was entered. For example, if the following series is entered

5 2   15   3   7   15   8   9   5   2   15   3   7

It would output the largest value is 15 and it was entered 3 times.

9. Write a program that creates the following pattern

```
1   2   3   4   5   6   7   8   9

1   2   3   4   5   6   7   8

1   2   3   4   5   6   7

1   2   3   4   5   6

1   2   3   4   5

1   2   3   4

1   2   3

1   2

1
```

10. Write a program that creates the following pattern with a given height.

```
*

*       *       *

*       *       *       *       *

*       *       *       *       *       *       *

*       *       *       *       *       *       *       *       *

*       *       *       *       *       *       *       *       *       *       *
```

11. Write a program that creates the following pattern with a given height (rows)

```
*   *   *   *   *   *   *   *   *   *   *

*   *   *   *   *   *   *   *   *

*   *   *   *   *   *   *

*   *   *   *   *

*   *   *

*
```

12. Write a program that creates the following pattern with a given height (rows)

```
*

*   *   *

*   *   *   *   *

*   *   *   *   *   *   *

*   *   *   *   *   *   *   *   *

*   *   *   *   *   *   *   *   *   *   *

*   *   *   *   *   *   *   *   *

*   *   *   *   *   *   *

*   *   *   *   *

*   *   *

*
```

13. Write a program that reads integer data from the standard input unit and prints a list of numbers followed by the minimum integer read, maximum integer read, and the average of the list. Test your program with the data shown below.

| 24 | 7 | 31 | -5 | 64 | 0 | 57 | -23 | 7 | 63 | 31 | 15 | 7 |

14. Euler's number, *e*, is used as a base of natural logarithms. It can be approximated using the following formula:

$$e = 1 + \frac{1}{1!} + \frac{1}{2!} + \frac{1}{3!} + \frac{1}{4!} + \cdots + \frac{1}{n!}$$

Write a program that approximate e using a loop that terminates when the difference between two successive values of e differ by less than 0.00000001.

15. Write a program to generate the following pattern with a given height from the user.

```
@   @   @   @   @   @   @   @   @   @   @

@   @   @   @   @       @   @   @   @   @

@   @   @   @               @   @   @   @

@   @   @                       @   @   @

@   @                               @   @

@                                       @

@   @                               @   @

@   @   @                       @   @   @

@   @   @   @               @   @   @   @

@   @   @   @   @       @   @   @   @   @

@   @   @   @   @   @   @   @   @   @   @
```