BIRZEIT UNIVERSITY

Department of Computer Science

COMP 1310

Extra Exercises

C Basics, Functions, Selection, and Loops

The following questions cover the topics of C basics, functions, selection structures, and loops.

When you write a program aim that your code be well-documented and written neatly with proper indentation.

Match your output to the output example that is given for each question.

Question 1: Write a program that does the following:

1. Read the coordinates of two points on earth from the user and calculates the distance between them. Assume that all coordinates are points on a plane, and use the following equation to calculate the distance:

$$distance = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

2. Read the speed of a car from the user and calculates the time that is required to go from the first point to the second point. Remember the following equation:

$$speed = \frac{distance}{time}$$

The output of your program must be ***exactly*** as follows:

```
Please enter the x and y coordinates of the first point:
53 98
Please enter the x and y coordinates of the second point:
382 800
The distance between the points (53, 98) and (382, 800)
is 775.27 km.

Please enter your car’s speed in km/h: 80
The time you will need to cross the distance in this car
is 9.69 hours.
```

Question 2: Write a program that does the following:

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1. Reads the speed of a car from the user and the distance they want to travel, then calculates the time that is required to go from the first point to the second point. Remember the following equation:

$$speed = \frac{distance}{time}$$

2. Converts the time to hours and minutes (remember, an hour is 60 minutes), and prints the time in the format of hh:mm. You can ignore any fractions that remain.

The output of your program must be ***exactly*** as follows:

```
Please enter your car’s speed in km/h: 80
Please enter the distance you want to travel in km: 956
The time you will need to cross the distance in this car
is 11.95.
This time equals to 11:56
```

Question 3: Write a program that does the following:

Read the number of water cubes that a household consumed, and calculate the value of their water bill based on the following rules:

Water Cube	**Cost**
1 – 8	3.90 shekels / cube
9 – 15	4.20 shekels / cube
16 – 23	4.70 shekels / cube
24 – 50	5.10 shekels / cube
Over 50	5.60 shekels / cube

This means that if a household consumes 20 cubes of water per month, their bill will:

  8 cubes * 3.90 shekels / cube
+ 7 cubes * 4.20 shekels / cube
+ 5 cubes * 4.70 shekels / cube = 84.10 shekels

Your program must include a function with the following prototype:

```
double water_cost (int);
```

This function takes the number of water cubes as input and returns the total cost as output. You are expected to use if statements to calculate the cost.

The output of your program must look ***exactly*** like this:

```
Enter the number of water cubes consumed: 20
Your water bill for this month is 84.10 shekels.
```

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Question 4: Write a program that does the following:

Read the base salary of an employee, and calculate their gross salary based on the following additions:

Base Salary	Housing Allowance	Travel Allowance	Medical Insurance
<= $500	15%	10%	$100
$501 - $1,000	20%	12%	$300
$1,001 - $2,000	25%	17%	$500
>= $2,001	30%	20%	$1000

You should have a function with the following prototype:

```
void gross_salary(double);
```

This function takes the base salary and calculates the gross salary, and prints a detailed pay stub.

The output of your program should look like this:

```
Please enter the base salary: 1200

Pay Stub
------------------
Base salary              $1200.00
Housing allowance        $300.00
Travel allowance         $204.00
Medical insurance        $500.00
------------------
Gross salary             $2204.00
```

Question 5: Write a program that reads a binary number of any size from the user as a regular integer, and converts it to a decimal number.

You can assume that the user will enter a proper binary number without errors.

The output of your program should look like this:

```
Please enter a binary number: 10110
This number in decimal is 22
```

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Question 6: Write a program that read an integer from the user and prints its factorial.

e.g. 5! = 1 x 2 x 3 x 4 x 5 = 120
n! = 1 x 2 x … x n-2 x n-1 x n

The output of your program should look exactly like this:

```
Enter an integer: 5
5! = 1 x 2 x 3 x 4 x 5 = 120
```

Question 7: Write a program that reads a character from the user and determines the following:

- If the character is a digit (ASCII for '0' is 48)
- If the character is an English letter (ASCII for 'A' is 65 and for 'a' is 97 – there are 26 letters in the English alphabet).
- If the character is an English letter, then the program should determine if it is a lower-case or an upper-case letter.
- If the character is a lower-case letter, it should print its upper-case counterpart, and if it is an upper-case letter, it should print its lower-case counterpart.

The program should continue asking for characters until the user enters the character '!' (ASCII 33).
Your program must include the following functions:

```
int is_number(char);
int is_letter(char);
int is_upper(char);
```

The output of the program should look like this:

```
Enter a character: a
a is a letter.
a is a lower-case letter.
The upper-case counterpart of a is A.
Enter a character: G
G is a letter.
G is an upper-case letter.
The lower-case counterpart of G is g.
Enter a character: 8
8 is a number.
Enter a character: ?
? is not a number or a letter.
Enter a character: !
```

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Question 8: Write a function that would approximate the value of the square root of a number. Your function should have the following prototype:

```
double square_root(double);
```

You can do that by repeatedly performing the following formula:

```
next_guess = (last_guess + (num / last_guess)) / 2;
```

where `last_guess` is the value you calculated in the previous execution of the loop. The starting value of `last_guess` should be the input number itself.

Repeat the calculation until the difference between next_guess and last guess is less than 0.0001. Print both your approximation and the actual value that can be calculated using the sqrt function.

The output of your program should look like this:

```
Enter a number: 89
The approximated square root is 9.433981
The actual square root is 9.433981
```

Question 9: Write a program that reads a month and a year from the user and prints the calendar of that month. You will need the following functions:

- `int is_leap_year(int year);`
  A year is a leap year if it is divisible by 400, or if it is divisible by 4 and not divisible by 100.
- `int get_total_days(int, int);`
- We know that January 1st, 1800 was a Wednesday. You should be able to use that information to calculate how many days have passed since then.
- `int get_starting_day(int month, int year);`
  We know that January 1st, 1800 was a Wednesday. You should be able to use that information to calculate the starting day of any month afterwards.
- `int get_days_of_month(int, int);`
  This function returns the number of days in any month of any year. January, March, May, July, August, October, and December have 31 days each, while April, June, September, and November have 30 days each. February has 28 days in regular years, and 29 in leap years.
- `void print(int, int);`
  This function calls all the other functions to get the relevant information, and prints the calendar that looks like this:

```
Enter a month and a year: 4 2021
     April, 2021
---------------------------
 Sun Mon Tue Wed Thu Fri Sat
                   1   2   3
   4   5   6   7   8   9  10
  11  12  13  14  15  16  17
  18  19  20  21  22  23  24
  25  26  27  28  29  30
```

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