EHB 110E - Introduction to Scientific and Engineering Computing (C)
FINAL EXAM - 5/2/2021

- Use the Microsoft Word file (Answers File) that is provided on Ninova, to write your answers.
- When you finish all answerings, save the Word file on your computer and exit from the Word program.
- Submit the Word file to Ninova from the Homeworks section.

QUESTION 1) [15 points] **Draw** the diagram of the memory (all variable contents and pointer arrows), after the following C program is executed completely.

```
#include <stdlib.h>
int main() {
  int a = 10, *p1, *p2;
  p1 = &a;
  *p1 += 15;
  p2 = (int*) malloc(sizeof(5));
  *p2 = (int) p1;
  *(p2 + 3) = 20;
  p1 = p2 + 4;
  *p1 = 30;
  p2++;
  *p2 = 40;
  *(p1 - 2) = 50;
}
```

QUESTION 2) [10 points] Write a C program to do the followings.

- Ask user to enter the **x** and **y** coordinate values (integers) of a **point** from keyboard.
- Also ask user to enter the **radius** value (integer) of a **circle** from keyboard.
- Check whether the point lies inside, outside, or on the circle whose centre is at the origin.
  CONDITIONS: $r^2 == x^2 + y^2$ (on the circle), $r^2 < x^2 + y^2$ (outside the circle) , $r^2 > x^2 + y^2$ (inside the circle)
- Display an appropriate result message on screen.

QUESTION 3) [25 points] Assume you are given a data file (ITEMS.TXT) which contains the following information in each row**: Item name** (max 10 chars), **Item amount** (integer). Write a C program to do the followings.

- By using built-in file functions (fopen, fscanf, feof) and looping, read all of the data from the file.
- Find the biggest item amount (**Max**) in the file.
- Calculate the histogram factor as : **Factor** = 50 / Max
- For each item, display a **histogram** by using the star symbols on screen.
- The number of stars for each item should be calculated by program by using the **Factor**.

Example screen output (Histograms):

```
AA   45 ***
BBB 160 ************
CC  275 **********************
....
....
```

QUESTION 4) [25 points] Write a C program to do the followings.

- Define an array of characters (string) and ask user to enter its value from keyboard. (Example user input: "**This is a testing sentence**")
- **By looping**, remove all of the vowels (A,a,E,e,O,o,U,u,I,i) from the string.
- The original string should be **modified,** so that it will not contain any vowels.
- Display the modified string on screen. (Example screen output: "**Ths s tstng sntnc")**

QUESTION 5) [25 points] The table below contains the flight departure times from one city to another. Write a C program to do the followings.

- Define the departure times as a two-dimensional array (matrix) as shown below.
  int time[8][2] = { {8, 0}, {9, 43}, {11, 19}, ... };
  The first column of matrix stores the hours, and the second column stores the minutes.
- Ask user to enter a specific time expressed in hours and minutes, using the 24-hour clock.
- **By looping,** determine and display the departure time which is **closest** to the time entered by the user. Example screen outputs:

```
Enter a 24-hour time (in hh mm format): 13  50
Closest departure time is 14:00
```

```
Enter a 24-hour time (in hh mm format): 13  15
Closest departure time is 12:47
```

Departure Times
08:00
09:43
11:19
12:47
14:00
15:45
19:00
21:45