Benha University

Computer Systems Engineering
Electrical Engineering Department

Faculty of Engineering
(at Shoubra)

Midterm Exam

Attempt five of the following questions (Time Allowed: 1 hour):

Question 1: (2 Marks)

Determine the output for each of the following code snippets:

a)

```
for (int i = 0; i < 5; i++) {
    for (int j = 0; j < 5; j++)
        cout << "";
    cout << endl;
}
```

b)

```
for (int i = 0; i < 5; i++) {
    for (int j = 0; j < 5; j++)
        if (i == j || i == 4 - j)
            cout << "";
        else
            cout << " ";
    cout << endl;
}
```

c)

```
for (int i = 0; i < 5; i++) {
    for (int j = 0; j < 5; j++)
        if ((i + j) % 2 == 0)
            cout << "";
        else
            cout << " ";
    cout << endl;
}
```

d)

```
for (int i = 0; i < 5; i++) {
    for (int j = 0; j < 5; j++)
        if (abs(i - 2) == 2 || abs(j - 2) == 2)
            cout << "";
        else
            cout << " ";
    cout << endl;
}
```

Question 2: (2 Marks)

Write a function `random999` that prints the integers from `0` to `999` in a random order.

Hint: How can you sort an array?

Question 3: (2 Marks)

According to *Collatz* conjecture, applying f indefinitely to any natural number will always eventually give `1`. Write a function `collatz` that takes a natural number `n` and prints the sequence resulting from applying f to `n` until `1` is reached.

$$f(n) = \begin{cases} n/2 & , n \text{ is even} \\ 3n+1 & , n \text{ is odd} \end{cases}$$

Example: Calling `collatz(6)` should print `6, 3, 10, 5, 16, 8, 4, 2, 1`

Question 4: (2 Marks)

Write a complete program that reads the parameters of a quadratic equation and prints its real or imaginary roots.

Hint: $x_{1,2} = (-b \pm \sqrt{b^2 - 4 \cdot a \cdot c})/(2 \cdot a)$

Examples:

Input:	1 5 6	1 -4 4	1 2 2
Output:	x_1 = -2 and x_2 = -3	x_1 = x_2 = 2	x_1 = -1+1i and x_2 = -1-1i

Question 5: (2 Marks)

Write a complete program that reads an array $X = \{x_i, i \in [1, N]\}, x \in [0, 99]$ and prints its histogram.

Hint: How can you find the histogram of a sequence of dice tosses (⚀⚁⚂⚃⚄⚅)?

Question 6: (2 Marks)

Write a function that takes a character grade (A, B, C, D, or F) and returns the integer GPA (4, 3, 2, 1, and 0 respectively).

Good Luck
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