



## 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)	b)
<pre>for (int i = 0; i &lt; 5; i++) {     for (int j = 0; j &lt; 5; j++)         System.out.print("■");     System.out.println(); }</pre>	<pre>for (int i = 0; i &lt; 5; i++) {     for (int j = 0; j &lt; 5; j++)         if (i == j    i == 4 - j)             System.out.print("■");         else             System.out.print(" ");     System.out.println(); }</pre>
c)	d)
<pre>for (int i = 0; i &lt; 5; i++) {     for (int j = 0; j &lt; 5; j++)         if ((i + j) % 2 == 0)             System.out.print("■");         else             System.out.print(" ");     System.out.println(); }</pre>	<pre>for (int i = 0; i &lt; 5; i++) {     for (int j = 0; j &lt; 5; j++)         if (abs(i - 2) == 2    abs(j - 2) == 2)             System.out.print("■");         else             System.out.print(" ");     System.out.println(); }</pre>

### Question 2:

(2 Marks)

Write a method 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 method 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:**

<b>Input:</b>	1 5 6	1 -4 4	1 2 2
<b>Output:</b>	$x_1 = -2$ 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 method 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  
Dr. Islam ElShaarawy