



Attempt 5 of the following questions (including questions 1 and 2)

No of Questions: 6 in 2 page(s)
Total Mark: 60

Question 1:

(12 Marks)

Determine the output for each of the following code snippets (assuming successful compilation):

a) (2 Marks)

```
for (int i = 0; i < 5; i++) {
    for (int j = 0; j <= 5; j++) {
        if (j == i + 1) break;
        cout << j;
    }
    cout << endl;
}
```

b) (2 Marks)

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

c) (2 Marks)

```
int i = 0;
do {
    cout << ++i << endl;
    cout << i++ << endl;
} while (i < 5);
```

d) (2 Marks)

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

e) (2 Marks)

```
for (int i = 0; i < 5; i++) {
    for (int j = 0; j < 5; j++) {
        char c;
        switch (abs(i - j)) {
            case 0 : c = '\\'; break;
            case 2 : c = '+'; break;
            case 4 : c = '.'; break;
            default: c = ' '; break;
        }
        cout << c;
    }
    cout << endl;
}
```

f) (2 Marks)

```
{
    int f1 = 1;
    int f2 = 1;
    for (int i = 1; i <= 5; i += 1) {
        cout << f1 << endl;
        f2 = f1 + f2;
        f1 = f2 - f1;
    }
}
```

Question 2:

(12 Marks)

For the three questions that you will solve later:

- | | | |
|----|---|-------------------------|
| a) | avoid syntax and runtime errors, | (4 Marks) |
| b) | validate the user input, | (4 Marks) |
| c) | prompt the user with meaningful instructions, and | (4 Marks) |
| d) | write the code using a clean style. | (4 Marks) ^{\$} |

Question 3:

(12 Marks)

Write a full program including three functions for printing the following patterns using only one '*' and one ' ' per function.

a) (4 Marks)

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

b) (4 Marks)

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

c) (4 Marks)

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

\$ Bonus

Question 4:

(12 Marks)

- a) (6 Marks)
Write a function `weekday` that takes an integer $d \in [1, 7]$ and returns a string representing the Arabic name.
- b) (6 Marks)
Write a full program that:
1. reads a weekday number from the user,
2. prints the weekday name returned from `weekday`, and
3. repeats if the user still needs to use the program.

Example: When the user enters 1, the program should print "السبت" (without the quotation marks)

Question 5:

(12 Marks)

Write a full program that reads an array of n numbers and prints its range. The range of an array is the difference between its maximum and minimum values. The program should consist of three functions:

- a) (4 Marks)
`read` for reading the array,
- b) (4 Marks)
`min` for finding the minimum value, and
- c) (4 Marks)
`max` for finding the maximum value.

Question 6:

(12 Marks)

In survey engineering, a *traverse* is an n -sided closed polygon. *Traverse angle balancing* is a process intended for adjusting (correcting) the measured internal angles of a given traverse according to the following equations. The target of this process is to make the actual sum of the corrected angles the same as the theoretical sum ($tsum$).

$$tsum = 180 \cdot (n - 2)$$

$$asum = \left(\sum_{i=1}^n a_i \right)$$

$$error = asum - tsum$$

$$correction = error / n$$

$$\hat{a}_i = a_i - correction \forall i \in [1, n]$$

Write a full program including three functions:

- a) (4 Marks)
`read` for reading three or more traverse angles a_1, a_2, \dots, a_n from the user,
- b) (4 Marks)
`correct` for performing *traverse angle balancing*, and
- c) (4 Marks)
`print` for printing the corrected angles $\hat{a}_1, \hat{a}_2, \dots, \hat{a}_n$ to the standard output.

Example: If the measured angles are $a = \{61.5, 60.5, 59.5\}$, then the corrected angles should be $\hat{a} = \{61.0, 60.0, 59.0\}$

Good Luck
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