EXAMINATION INSTRUCTIONS

* Do not turn this page until asked to do so.
* Exam time is 75 minutes.
* Put the answers on the same question sheet, do not use any additional papers, even for scratch.
* Write your name, ID, section no. in the indicated places.
* Read the exam instructions.
* Read the honesty policy.
* Sign the following statement.

Academic Integrity Policy

Cheating in Exams is a violation of the honesty policy of AUC. Whispering, talking, looking at someone else’s paper, or copying from any source is considered cheating. Any one who does any of these actions or her/his answers indicates that she/he did any of them, will receive a punishment ranging from zero in this exam to failing the course. If repeated, it may lead to dismissal from AUC.

I have read the honesty policy and exam instructions and I am presenting this exam as entirely my effort.

Signature: ____________________

DO NOT USE THIS SECTION

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**Question 1 (15 points)**
Show the output of each of the following program segments:

```cpp
# Int a = 5;
# Int b = 2;
# If (a < b)
#    for (k = a; k <= b; k++)
#       cout << k << endl;
# else
#    for (k = a; k >= b; k--)
#       cout << k << endl;
```

```cpp
# int x = 4, y = 1;
# while (x > 4)
#    {    y *= x++;
#       cout << "x = " << setw(2) << x << "y = " << setw(2) << y << endl;
#    }
# cout << "Final x = " << setw(2) << x << "Final y = " << setw(2) << y << endl;
```

```cpp
# float a = 2, b = 2, c = 1.5, x;
# int d = 5, e = 4.5, y, z;
#    x = a * b - c + d / e;
#    y = a * (b - c) + d / e;
#    z = a * (b - (c + d - 0.5) / e);
# cout << "x = " << setw(4) << x << "  y = " << setw(4) << y << "  z = " << setw(4) << z << endl;
```

```cpp
# int x = 1, y = 1, z;
# y = y * x++;
# cout << "x = " << setw(2) << x << "y = " << setw(2) << y << endl;
# x = 6;
# y = 2;
# z = -x / y++;
# y = z++ + x++;
# cout << "x = " << x << "  y = " << y << "  z = " << z << endl;
```
Question 2 (20 points)
Write a C++ program that takes a positive integer number not less than 0 and not more than 999. The program checks the number and prints the message “One BIG digit” if the number is composed of only one digit, the message “Two BIG digits” if it is composed of two digits and the message “Three BIG digits” otherwise.

Show the three phases of software development: the analysis, design, and implementation.
Enforce validation on the user input such that it is not less than 0 and not greater than 999.

The Analysis

The Flow Chart
**Question 3 (15 points)**

Write a C++ program that uses *only two nested loops* to produce the following output:

```
  @
  1  2
  @  @  @
  1  2  3  4
  @  @  @  @  @
  1  2  3  4  5  6
  @  @  @  @  @  @  @
  1  2  3  4  5  6  7  8
  @  @  @  @  @  @  @  @
```

---

**Question 4 (10 points)**

Using only one variable, write only one C++ for-loop to generate the following series:

```
  2  5  17  65  257  513
```

---
**Question 5 (15 points)**
The following C++ program takes a positive integer representing a binary number (composed of only 0s and 1s, such as 111010), computes and displays its equivalent decimal value. The program should accept only such number greater than 0 and not more than 111111. There are some missings (represented by dots) in the given program. Complete these missings such that the program could be compiled and run correctly.

```cpp
#include <iostream>
#include <iomanip>
using namespace std;

void main ()
{
    int num, nn, d, sum, b = 1;
    const int ten = 10;
    // complete these missings
    cout << "Enter a positive number composed of 0s and 1s greater than 0 and not more than 111111:";
    cin >> num;
    while ( )
    {   cout << "Invalid input, Enter a positive number composed of 0s and 1s greater than 0 and not more than 111111:";
        cin >> num;
    }

    nn = num;
    while ( nn != 0)
    {   d = nn .......... ten;
        sum = sum + d * b;
        b = ...................;
        nn = nn / ........;
    }
    cout << "The binary number " << setw(8) << num << " is equivalent to " << setw(5) << sum << endl;
}
```
Question 6 (25 points)
Write a C++ program to enter scores of n students in a test. The number of scores (n) should not exceed 30 and each entered score is an integer value between 0 and 100 (inclusive). The program should accept only valid values, compute and print out the average and highest scores together with the number of scores that are above 90. Include in your program the necessary controls to validate the user input.

The Program

```cpp

```

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Question 5 (25 points)
Write a C++ program to enter scores of \( n \) students in a test, compute and print out the average, maximum, and minimum scores. The program should also compute and display the number of scores that are below 50 and the number of scores that are over 90. The computer should validate the user input such that \( n \) should be greater than 0 and not more than 30 and each score to be between 0 and 100 (inclusive). Format the computed average score to the nearest hundredth.

The Program

```
```

Good Luck

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