

The American University in Cairo
Computer Science & Engineering Department
CSCE 106

Instructor:	Final Exam	Spring 2010
Last Name :		ID:
First Name: Section No.:		

EXAMINATION INSTRUCTIONS

- * Do not turn this page until asked to do so.
- * Exam time is **120** 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

Question	Points	Grade
1	10	
2	20	
3	5	
4	15	
5	15	
6	15	
7	20	
Total	100	

Question 1 (10 points)

Tick only one possible answer for each of the following:

- 1) The Compiler is a software that:
 - a. translates a high-level language program into machine language []
 - b. translates an assembly language program into machine language []
 - c. lets users display and view a web document []
 - d. None of the above []
- 2) Summing up all even integers is a nonalgorithmic problem, because:
 - a. It's too difficult to compute []
 - b. It involves infinite number of operations without termination []
 - c. No machine can do it []
 - d. The algorithm to do it will very long []
- 3) The value of **(x - 4 != 4) && (x - 4 == 4)** is:
 - a. **x - 4** []
 - b. True []
 - c. **x + 4** []
 - d. None of the above []
- 4) $(11111111)_2$ is equivalent to:
 - a. $(128)_{10}$ []
 - b. $(127)_{10}$ []
 - c. $(255)_{10}$ []
 - d. None of the above []
- 5) Von Neumann architecture is:
 - a. A stored-program computer []
 - b. A web browser []
 - c. An architecture for RAM []
 - d. All the above []
- 6) Software Piracy is:
 - a. Violation of copyright agreements by illegally copying software []
 - b. Code disrupting the computer operations and erasing information []
 - c. A Computer theft or computer fraud []
 - d. A biological disease causing malfunctioning of the computer []
- 7) The RAM is used to:
 - a. To store fixed code to start up the computer []
 - b. To store programs and data that are to be executed []
 - c. To perform the arithmetic and logical operations []
 - d. none of the above []
- 8) In binary: $1011 + 11011 = ?$
 - a. 101000 []
 - b. 100110 []
 - c. 110110 []
 - d. 100101 []
- 9) The ALU is the unit of computer responsible of:
 - a. Storing programs and data permanently []
 - b. Performing arithmetic and logical operations []
 - c. Performing Input/Output operations []
 - d. None of the above []

Question 2 (20 points)

Show the output of each of the following program segments:

<pre>int myfunc(int n); int main () { cout << setw(5) << "k" << setw(12) << "myfunc(k)" << endl; for (int k=0; k <= 6; k += 2) cout << setw(5) << k << setw(12) << myfunc(k) << endl; } int myfunc(int n) { int f = 1; for (int m=2; m <= n; m++) f = m * f; return f; }</pre>	
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<pre>int x = 1, y = 1; while (x < 4) { y = y * x++; cout << "x = " << setw(2) << x << "y = " << setw(2) << y << endl; }</pre>	
--	--

<pre>int BB[4]; const int two = 2; int n = 14; int c = 3; int nn = n; do { BB[c] = nn % two; nn /= two; c--; } while (nn != 0); cout << "The equivalent value of " << n << " is "; for (int k = 0; k < 4; k++) cout << BB[k]; cout << endl;</pre>	
--	--

<pre>float a = 2, b = 2, c = 1.5, x; int d = 4, e = 5.5, 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;</pre>	
--	--

Question 3 (5 points)

Assume **a**, **b**, and **c** are int variables and have the following values: **a** = 10, **b** = 20, **c** = 30. Using only one additional variable, write C++ statements to rotate the value of **a**, **b**, and **c** so that **a** has the value of **c**, **b** has the values of **a**, and **c** has the value of **b**.

.....

.....

.....

.....

.....

Question 4 (15 points)

Solve only (A) or (B)

(A)

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

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

(B)

Write a C++ program that creates a table of degrees Celsius with the corresponding degrees Fahrenheit. Begin at 0°C and proceed to 100°C in 20°C increments. Make your table of two columns with appropriate headers. Use the following formula to convert from Celsius to Fahrenheit:

Fahrenheit = (9/5) Celsius + 32

[illegible]

A country charges its citizens an income tax each year. The tax rate is based on the Income of the year according to the following table:

Income (\$)	Tax Rate
Income < 10000	5.5%
10000 <= Income < 20000	10.4%
20000 <= Income < 40000	15.6%
Income >= 40000	23.7%

Draw a flow chart and write a program in C++ reads a person's income, prints the tax owed rounded to the nearest dollar. **Show the three phases of software development: the analysis, design, and implementation. Implement your solution in C++ using nested-if structure, and second using the switch structure. Enforce validation on the input Income such that it is not less than 0 and not greater than 100000.**

The Analysis

[illegible]

The Flow Chart

This image shows a full page of white paper with horizontal dotted lines. The lines are evenly spaced and run across the width of the page, providing a guide for handwriting practice. There are no margins, text, or other markings on the page.

The Program Using nested-if structure

This image shows a full page of a document template. It consists of approximately 30 evenly spaced horizontal dotted lines across the entire width of the page, providing a guide for handwriting or typing. There are no margins, text, or other markings present.

The Program Using switch structure

[illegible]

Question 6 (15 points)

If the sum of digits of any positive integer number is divisible by 9, the number itself is also divisible by 9. For example, the number 459 is divisible by 9 because the sum of its digits 4, 5, and 9 is equal to 18 which is divisible by 9. Also, the number 29961 is divisible by 9 because the sum of its digits 2, 9, 9, 6, 1 is 27 which is divisible by 9, while, the number 7628 is not divisible by 9 because the sum of its digits 7, 6, 2, and 8 is 23 which is not divisible by 9.

The following C++ program takes a positive integer number greater than 99 and less than 99999 and checks whether it is divisible by 9 or not, using the above mentioned technique. There are some missings (represented by dots) in the given program. Complete these missings such that the program could be compiled and run correctly.

The Program

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

void main ()
{
    int num, d, sum, nn;
    .....;

    do
    {
        cout << "Enter a positive integer number greater than 99 and less than 99999" << endl;
        cin >> num;
    } while (.....);
    nn = num;
    while ( nn != 0 )
    {
        d = .....;

        sum = sum + d;

        nn = .....;
    }

    if (.....)
        cout << "The number " << setw(6) << num << " is divisible by 9" << endl;
    else
        cout << "The number " << setw(6) << num << " is NOT divisible by 9" << endl;
}
```

Question 7 (20 points)

Solve only (A) or (B)

(A)

A perfect number is a positive integer having the property that the sum of its factors (including 1) equal to the number itself. The first perfect number is 6 because its factors are 1, 2 and 3 and their sum is 6 which is equal to the number itself. The next perfect number is 28 because its factors are 1, 2, 4, 7 and 14 and their sum is 28 which is equal to the number itself. Write a **modular** C++ program that prints a list of all the perfect numbers in the range of 100 to 1000.

(Hint: Define a function **perfect** that takes a number to check it and return an appropriate output indicating the case).

(B)

Write a modular program in C++ (a **main** function and a user-defined function **binaryToDecimal**) to perform the following:

1. Read an integer number containing only **0**s and **1**s (i.e., a “binary” integer such as **10011**).
2. Use the function **binaryToDecimal** that takes as an input the entered integer number of step (1) and computes its decimal equivalent.
3. Print out the computed decimal equivalent in appropriate format.
4. Repeat steps 1, 2, and 3 until a **0 (zero)** is entered for the input integer number.

[illegible]

Good Luck