National Institute of Public Administration

BACHELOR OF COMPUTER SCIENCE (BCS)

BoCS1020: ITNRODUCTION TO COMPUTER SCIENCE

DECEMBER 2020 EXAMINATION SEMESTER II

***TIME ALLOWED*: THREE HOURS**
***TIME*: 08:30 to 12:00**
***DATE*: 17/12/2020**
***VENUE*: GF7**

INSTRUCTIONS TO CANDIDATE:

1. This paper contains **SEVEN** questions**;**

2. Section A is **compulsory** (QUESTIONS 1, 2 and 3) while you are expected to attempt any **TWO** questions from Section B;

3. Number each answer clearly in the left margin;

4. Start each answer on a new page;

5. **Total marks: 60.**

6. **NO CALCULATORS ALLOWED.**

DO NOT TURN THIS PAPER UNTIL TOLD TO DO SO
PLEASE LEAVE THE ANSWER SCRIPT BEHIND AFTER THE EXAMINATION

SECTION A –COMPULSORY: ATTEMPT ALL QUESTIONS

QUESTION 1

a) Give characteristics of the Von Neumann architecture **[3 Marks]**
Input/output, memory, processing

b) What is the main reason for computers to use binary system? **[2 Marks]**
Stability On/Off Yes/No True/False +/-

c) Write an algorithm that gets the price for item A plus the quantity purchased. The algorithm prints the total cost, including a 16% sales tax. **[5 Marks]**

Steps Operation

1. Get price and quantity of item A [1 marks]
2. Sets cost to price x quantity [1 Marks]
3. Sets total_cost to (cost + cost x 0.06) [2 Marks]
4. Print total_cost [1 Marks]

QUESTION 2

a) Convert the following to binary 253 and 109 **[4 Marks]**
b) Convert the following to decimal 11010101 and 10101010 **[4 Marks]**
c) Calculate the following 1101 + 0111 **[2 Marks]**

QUESTION 3

Letter	**4-bit Encoding**
A	0000
I	0001
H	0010
W	0011
E	0100
O	0101
M	0110
K	0111
U	1000
N	1001
P	1010
L	1011

Given the four-bit encoding scheme of the computer above, provide machine language equivalent of the following terms: **[2 Marks Each]**

a) NIPA 1001 0001 1010 0000

b) WELL

c) NOPE

d) HOME

e) LOOK

SECTION B – This section has **FOUR** questions; you are expected to attempt any **THREE** of them.

QUESTION 4

Develop an algorithm to compute gross pay. The inputs to your algorithm are the hours worked per week and the hourly pay rate. The rule for determining gross pay is to pay the regular pay rate for all hours worked up to 50. Anything above 50 pay extra double rate. Compute and display the value for gross pay using this rule. After displaying one value, ask the user whether he or she wants to do another computation. Repeat the entire set of operations until the user says no. Determine the efficient of your algorithm in terms of complexity and space. **[10 Marks]**

```
Steps   operations
1       get hours and rate
2       set compute = yes
        set total to 0
3       while(compute = yes) do steps 4 to 13
4               get hours and rate
5               if(hours < = 50) do step 6
6                       gross_pay is hours x rate
7               else
8                       gross_pay is ((rate x 50) + (hours – 50) x rate x 2)
9               print gross_pay
10              print “Do you want to continue, enter yes or no”
11              set compute to choice in step 10
12
13      end loop
```

QUESTION 5

Given the following Boolean expressions, come up with the **Circuit** and **Truth Table**:

a) (a.b).(~a+a)+(a.~b) **[4 Marks]**

b) (~a+~b)+(a+b)+(~a+b)+(a+~b) **[6 Marks]**

QUESTION 6

The following is Euclid's 2,300-year-old algorithm for finding the greatest common divisor of two positive integers I and J.

Step	Operation

1	Get two positive integers as input; call the larger value I and the smaller value J
	If(J==0)
	Print error message
	Else

2	Divide I by J, and call the remainder R
3	If R is not 0, then reset I to the value of J, reset J to the value of R, and go back to Step 2
4	Print out the answer, which is the value of J
5	Stop

a) Go through this algorithm using the input values 20 and 32. After each step of the algorithm is completed, give the values of I, J, and R. Determine the final output of the algorithm. **[5 Marks]**

Pass 1	**step 1**	**I=32, J=0**
	Step 2	**32/0=1, R=12**
	Step 3	**I=20, J=12**
Pass 2	**Step 2**	**20/12=1, R=8**
	Step 3	**I=12, J=8**
Pass 3	**Step 2**	**12/8=1, R=4**
	Step 3	**I=8, J=4**
Pass 4	**Step 2**	**8/4=2, R=0**
	Step 4	**answer = 4**

b) Does the algorithm work correctly when the two inputs are 0 and 32? Describe exactly what happens, and modify the algorithm so that it gives an appropriate error message. **[5 Marks]**

QUESTION 7

An operating system is a single most important piece of software.

a) Discuss at least five (5) functions of the operating systems. **[5 Marks]**
b) List two (2) operating systems you are aware of and at least three (3) difference between them. **[5 Marks]**

End of the Examination