



## UNIVERSITY OF GHANA

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**BA/BSc COMPUTER SCIENCE/INFORMATION TECHNOLOGY, SECOND SEM**

**ESTER EXAMINATIONS: 2015/2016**

**CSIT 104: MATHEMATICS FOR IT PROFESSIONALS (3 CREDITS)**

**INSTRUCTION:**

**Section A:** *Answer all questions (40 Marks)*

**Section B:** *Answer any four (4) questions. Each question carries 15 Marks*

**TIME ALLOWED:**

*TWO AND A HALF (2½) HOURS*

**Section A**

1. Consider the statement form  $p \rightarrow q$  where  $p$  = "If Kwame is Adwoa's father then Adwoa is Kofi's niece" and  $q$  = "Kofi is Kwame's brother." Which of the following statements is equivalent to this statement?

- a) If Kofi is Kwame's Brother, then Kwame is Adwoa's father and Adwoa is not Kofi's niece.
- b) If Kofi is not Kwame's Brother, then Kwame is Adwoa's father and Adwoa is not Kofi's niece.

- c) If Kofi is not Kwame's Brother, then Kwame is Adwoa's father or Adwoa is Kofi's niece.
- d) If Kofi is Kwame's Brother, then Kwame is Adwoa's father and Adwoa is Kofi's niece.

1. Consider the statement, "If  $n$  is divisible by 30 then  $n$  is divisible by 2 and by 3 and by 5."

Which of the following statements is equivalent to this statement?

- a) If  $n$  is not divisible by 30 then  $n$  is divisible by 2 or divisible by 3 or divisible by 5.
- b) If  $n$  is not divisible by 30 then  $n$  is not divisible by 2 or not divisible by 3 or not divisible by 5.
- c) If  $n$  is divisible by 2 and divisible by 3 and divisible by 5 then  $n$  is divisible by 30.

d) If  $n$  is not divisible by 2 or not divisible by 3 or not divisible by 5 then  $n$  is not divisible by 30.

1. Which of the following statements is the contrapositive of the statement, “You win the game if you know the rules but are not overconfident.”

a) If you lose the game then you don’t know the rules or you are overconfident.

b) A sufficient condition that you win the game is that you know the rules or you are not overconfident.

c) If you don’t know the rules or are overconfident you lose the game.

d) If you know the rules and are overconfident then you win the game.

1. The statement form  $(p \rightarrow r) \rightarrow (q \rightarrow r)$  is equivalent to

$$\Leftrightarrow \Rightarrow \Leftrightarrow$$

a)  $[(\sim p \rightarrow r) \rightarrow (p \rightarrow \sim r)] \rightarrow [(\sim q \rightarrow r) \rightarrow (q \rightarrow \sim r)]$

b)  $\sim[(\sim p \vee r) \wedge (p \vee \sim r)] \vee [(\sim q \vee r) \wedge (q \vee \sim r)]$

c)  $[(\sim p \vee r) \wedge (p \vee \sim r)] \wedge [(\sim q \vee r) \wedge (q \vee \sim r)]$

d)  $\sim[(\sim p \vee r) \wedge (p \vee \sim r)] \wedge [(\sim q \vee r) \wedge (q \vee \sim r)]$

$$\vee \wedge \vee \vee \vee \wedge \vee$$

1. A sufficient condition that a triangle  $T$  be a right triangle is that  $a^2 + b^2 = c^2$ . An equivalent statement is:

- a) If  $T$  is a right triangle then  $a^2 + b^2 = c^2$ .
- b) If  $a^2 + b^2 = c^2$  then  $T$  is a right triangle.
- c) If  $a^2 + b^2 \neq c^2$  then  $T$  is not a right triangle.
- d)  $T$  is a right triangle unless  $a^2 + b^2 = c^2$ .

1. Let then

- a)
- b)
- c) +
- d)
- e)

1. Which of the following function is periodic?

- a) to the real number  $x$
- b)
- c)
- d)
- e) None of these

1. If equals

- a)
- b)
- c)
- d)
- e) None of these

1. Let  $R$  be the set of real numbers. If  $f$  is a function defined by  $f(x) = x^2$ , then  $f$  is

- a)
- b) Injective but not surjective
- c) Surjective but not injective
- d) Bijective
- e) None of these

1. If

- a)
- b) is given by
- c) is given by
- d) does not exist because  $f$  is not one-one

e) does not exist because  $f$  is not onto

1. What number will fill the blank in this series: 8, 43, 11, 41, \_\_\_\_\_, 39, 17

a)

b) 8

c) 14

d) 43

e) 44

1. What is the value of  $17 \bmod 5$

a)

b) 3

c) 2

d) 6

e) 0

1. Encode : ADV ALG given the encoder matrix

a)

b)

c)

d)

e)

1. Let  $a_n$  be the sequence recursively defined by  $a_1 = 2$ ,  $a_2 = 3$ ,  $a_n = a_{n-1} a_{n-2}$  for  $n \geq 3$ . Compute the first five terms  $a_1, \dots, a_5$ .

a)

b) 100

c) 109

d) 108

e) 107

1. How many ways can a committee of 3 faculty members and 2 students be selected from 7 faculty members and 8 students?

a)

b) 98 ways

c) 890 ways

d) 980 ways

e) 89 ways

1. Write down a formula for the sequence 3, 4, 6, 9, 13, 18, 24, 31, 38, ...

a)

b)

c)

d)

e)

*Use the following set problem to answer questions 17 – 19.*

The records of 1492 high school graduates were examined and the following information was obtained:

1072 took biology and 679 took geometry. If 271 of those took geometry did not take biology, how many graduates took the following:

1. Both classes

a)

b) 409

c) 408

d) 804

e) None of these

1.



2. At least one of the classes

- a)
- b) 1343
- c) 3143
- d) 4313
- e) 3431

1. Neither class

- a)
- b) 149
- c) 119
- d) 134
- e) None of these

1. A character is represented on the computer as 10100000. What is the value in decimal?

- a)
- b) 159
- c) 171
- d) 128

e) None of these

1. What will be the value of  $19FDE_{16}$  in decimal?

a)

b)  $106462_{10}$

c)  $106463_{10}$

d)  $106461_{10}$

e)  $106464_{10}$

1. Evaluate

a)

b)

c)

d)

e)

1. An investment club has 200 members, 137 of whom invest in their stocks or bonds. 94 invest in stocks and 73 invest bonds. How many invest in both stocks and bonds.

a)

- b) 30
- c) 25
- d) 35
- e) 63

1. Let  $R = \{(3, 3) (6, 6) (9, 9) (12, 12), (6, 12) (3, 9) (3, 12) (3, 6)\}$  be a relation on set  $A = \{3, 6, 9, 12\}$ . The relation is

- a)
- b) reflexive and transitive
- c) reflexive only
- d) an equivalence relation
- e) reflexive and symmetric only

1. Find the gradient of the line  $6y - x = 3$

- a)
- b)
- c)
- d)
- e) None of these

1. Three letters are chosen from the word RANDOMLY. Find the probability that all the letters are consonants.

- a)
- b)
- c) 56
- d)
- e) 20

1. In how many ways can first, second, and third places be awarded in a race, if there are ten competitors?

- a)
- b) 90
- c) 720
- d) 72
- e) 760

*Use the following problem to solve questions 28 and 29*

The 4<sup>th</sup> and 8<sup>th</sup> terms of a G.P. are 2 and respectively.

1. Find the first term.

a)

b)

c) 16

d)

e) 16

1. Find the common ratio.

a)

b)

c)

d)

e)

1. Find the:

a)

b) 2

c) 3

d) 4

e) 5

1. Find the derivative of

a)

b)

c)

d)

e)

1.

2. Find the equation of the tangent to the curve at the point where

a)

b)

c)

d)

e)

1. If the radius of a spherical ball is increasing at the rate of  $0.2 \text{ cm s}^{-1}$ . At what rate is the rate is the volume increasing when the radius is 6cm? Leave your answer in terms of.

a)

b) 28

c) 24

d) 82

e) 42

1. Find the remainder when is divided by

a)

b) 19

c) -19

d) 91

e) -91

1. Find the value of

a)

b) 4

c) 2

d) 8

e) 6

1.

2. Simplify

- a)
- b) 1
- c)
- d) 27
- e)

1. Find the value of

- a)
- b) 1.5
- c) 1.2
- d) 2.0
- e) 0.5

1. What are the coefficients for the expression

- a)
- b) 1, 6, 15, 20, 15, 6, 1
- c) 1, 5, 15, 20, 15, 5, 1
- d) 1, 5, 10, 20, 10, 5, 1
- e) 1, 6, 10, 20, 10, 6, 1



1. Express 0.22222 as a series and find the limit of the series.

a)

b)

c)

d)

e)

1. Find the product of A and B given and

a)

b) (-29, 23)

c) (-92, 32)

d) (23, -29)

e) (32, -92)

## **Section B (60 Marks)**

*Answer any four questions. Each question carries 15 marks*

### **Question 1**

In a study of pleas and prison sentences, it is found that 45% of the subjects studied were sent to prison. Among those sent to prison, 40% chose to plead guilty. Among those not sent to prison, 55% chose to plead guilty.

- a) If one of the study subjects is randomly selected, find the probability of getting someone who was sent to prison.
- b) If one of the study subjects is randomly selected, find the probability of getting someone who was not sent to prison.
- c) If a study subject is randomly selected and it is then found that the subject entered a guilty plea find the probability that this person was not sent to prison.
- d) If a study subject is randomly selected and it is then found that the subject entered a guilty plea find the probability that this person was sent to prison.

### **Question 2**

- i. A panel of 3 men and 2 women have to form a committee of 3. If three are selected at random, find the probability that;
  - a) the committee will consist of 3 men
  - b) one woman will be selected

- c) at least one woman will be selected
- d) one particular man must be on the committee

ii. Using the Euclidean algorithm find the GCD of (1776, 1492)

### Question 3

a) Determine the validity of the argument: If it rains then the game will not be played. It is not raining. Therefore the game will be played

b) i. Construct a truth table for  $(p \rightarrow q) \rightarrow (p \vee q)$

ii. Use that to determine truth value of  $(p \rightarrow q) \rightarrow (p \vee q)$

a) A bag contains 8 red, 3 blue and 13 yellow discs. A disc is selected at random from the bag.

What is the probability that the disc selected is:

- i) Red
- ii. Blue
- iii. Yellow
- iv. Not Yellow

### Question 4

a) Prove using mathematical induction that for all  $n \geq 1$ ,  $1 + 4 + 7 + \dots + (3n - 2) = n^2$ .

b) Use the Principle of Mathematical Induction to verify that, for  $n$  any positive integer,  $6^n - 1$  is divisible by 5.

c) Use Pascal's triangle to expand and simplify the following:

i.  $(1 + x)^5 + (1 - x)^5$

Use the results from (i) to find the value of:  $(1 + 2)^5 + (1 - 3)^5$

### Question 5

You fill up your car with 15 gallons of premium gasoline and fill up a 5 gallon gas can with regular gasoline for various appliances around the house. You pay the cashier GHC 42. The price of regular gasoline is 20 cedi less per gallon than the price of premium gasoline. Find the price per gallon of regular and premium gasoline.

- a) Write the system of linear equations. Define your variables.
- b) Rewrite the system as a matrix equation.
- c) Find the solution  $X = A^{-1}B$

### Question 6

There are 800 guests at a party. 300 of the guests of the party are males, 315 are young people and 355 are married people. Additionally, 109 are young males, 167 are married males, 193 are young married people and 95 are young married males.

- a) How many old married males are at the party?
- b) How many young married females are at the party?
- c) How many young bachelors males are at the party?
- d) How many old bachelors males are at the party?
- e) How many old married females are at the party?
- f) How many old spinsters are at the party?
- g) How many young spinsters are at the party?