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Beyond A Graduate

PAST PAPERS

Faculty	Department / Section/Division
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Past Papers

Faculty of Engineering and Technology
Department of Information Technology

BSc. (Hons) in Software Engineering

End Semester Examination

(Year 2 – Semester I)

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Faculty of Engineering and Technology
Department of Information Technology
BSc (Hons) in Software Engineering
IT_UGC_001/IT_IFLS_001

Year 2 Semester 1

SEMESTER END EXAMINATION

Software Architecture and Design- SE2102

- There are EIGHT (08) questions in this paper.
- This paper contains four (04) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.11.23 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

(a) Define the term "**Software Architecture**". (02 Marks)

(b) Several characteristics of a software system provided below. Mark whether they are a **functional requirement**, a **quality attribute** or a **design constraint**. (06 Marks)

a. The system shall run on Windows and Linux - .....
b. The system shall record all user logins - .....
c. The system shall allow users to pay online for their purchases - .....
d. The system shall show the stock changes to the manager - .....
e. The system shall be implemented using JAVA - .....

(c) Briefly explain the importance of "correctness" and "robustness" in software design. (06 Marks)

(d) Discuss two (02) main key roles of Software Architecture in software development. (06 Marks)

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Question 02 (20 Marks)

Consider a software system which has designed for online food ordering.

Online food ordering system allows users to order food items online via their webpage for home delivery. Before place an order customer could search for the items and put them in to shopping basket. They also could add more items in different times and remove unwanted items from the basket.

At the completion of adding items customer must enter shipping address and they could pay online or select cash in delivery option. Food ordering system has provided facilities for their regular customers to register with the system to save their time of entering same details again and again.

(a) List three (03) functional and two (02) non-functional requirements of the above system in correct format. (05 Marks)

(b) Draw the use case diagram for the online food ordering system and give the use case detailed description for the use case "pay online". (15 Marks)

Question 03 (20 Marks)

(a) Define the term "Software Process". (02 Marks)

(b) Briefly explain "Waterfall" methodology. (08 Marks)

(c) Write six (06) leading design principles and briefly explain any two (02) of them. (10 Marks)

Question 04 (20 Marks)

A university is planning to implement a special type of digital card system to its students which could be used for different purposes within the University. Students can gain access to certain locations of the university (Library, laboratories, hostels, etc…) using this digital card. They also can use this card as a debit card issued from university bank to deposit and

withdraw money and to do payments within the university premises for different purposes (when purchasing foods form university café, transport payment, library deposits, examination payments, etc.). University will keep records of the students, their accounts, digital cards and the usage of the digital card by the students in their system.

(a) Draw a class diagram to represent above scenario. (12 Marks)

(b) Briefly explain four (04) visibilities that you could assign for different attributes for a class in class diagrams. (08 Marks)

Question 05 (20 Marks)

(a) What are design patterns? Briefly explain their use in software design. (04 Marks)

(b) Write four (04) advantages of using design patterns. (04 Marks)

(c) Briefly explain below design patterns with aid of suitable UML diagrams.

I. Singleton pattern

II. Factory pattern (12 Marks)

Question 06 (20 Marks)

(a) What are interaction diagrams? Give two (02) examples for interaction diagrams. (04 Marks)

(b) Explain below terms used in class diagrams with examples.

a. Aggregation

b. Composition (06 Marks)

(c) What are coupling and cohesion. Briefly explain why they are important in software architecture design. (10 Marks)

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Question 07 (20 Marks)

(a) Describe the layered software architecture and give one advantage and one disadvantage of it. (04 Marks)

(b) Briefly explain Two Tier client/server architecture pattern. (06 Marks)

(c) With the aid of a clear diagram explain the influence of stakeholders in software architecture design. (10 Marks)

Question 08 (20 Marks)

Breifly explain.

(a) Encapsulation

(b) Prototyping

(c) Reusability

(d) Inheritance (05 Marks *4)

----------END OF THE QUESTION PAPER----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Object Oriented Concepts & Programming- IT2108

- There are EIGHT (08) questions in this paper.
- This paper contains six (06) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.11.21 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

(a) What is Object Oriented Programming (OOP)? Describe in detail. (04 Marks)

(b) Name four(04) advantages of OOP compared to Structural Programming. (04 Marks)

(c) Name at least four(04) the basic concepts of Object Oriented Programming. (04 Marks)

(d) Describe at least two (02) features of a static member of a class. (04 Marks)

(e) What happens when a return type, even **void,** is specified for a constructor? (04 Marks)

Question 02: (20 Marks)

(a) Explain how overloading is used to determine which function to call in a class. When is the decision made as to which function is to be called? (02 Marks)

(b) Is polymorphism an essential feature in inheritance? Justify. (02 Marks)

(c) You are supposed to write a Java application for the academic department of CINEC. In the Academic department, there are Lecturers. Lecturers can be of two categories namely permanent lecturers and visiting lecturers. So that your application will have three classes called Lecturer, Permanent Lecturer and Visiting Lecturer.

A lecturer has a name, address and an employee ID as properties. A permanent lecturer has a name, address, employee ID and a basic salary as properties. A visiting lecturer has a name, address, employee ID, number of visiting hours per month and hourly rate as properties.

For every Lecturer we can calculate the amount we pay to the lecturer at the end of the month. So that the lecturer class will contain a method called ***calculatePayments()*** to calculate that amount and to return. A permanent Lecturer will be paid the basic salary and 10% of the basic salary as an allowance. A visiting lecturer will be paid an amount which is equal to the multiplication between visiting hours per month and hourly rate.

i. Name the attribute you are including to the three classes. (02 Marks)

ii. Can Lecturer class become a concrete class? Explain. (02 Marks)

iii. Write ***Lecturer*** class, include at least 2 constructors to the class. Use keyword ***this*** in appropriate places. (03 Marks)

iv. Write the ***PermanentLecturer*** class. You should include at least 1 constructor to the class and must override ***calculatePayments()*** method. Use keyword ***this*** and ***super*** in appropriate places. (04 Marks)

v. Write VisitingLecturer class. You shloud include 1 constructor to the class and must override ***calculatePayments()*** method. Use keyword ***this*** and ***super*** in appropriate places. (05 Marks)

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Question 03 (20 Marks)

(a) Briefly explain the concept of inheritance and discuss the advantages of using inheritance in Object Oriented Programming. (06 Marks)

(b) Consider the following class definition that is written without methods. Instead, it has comments followed by blank areas denoted by ..... to describe what each method has to do. Add method definitiopns in those blank areas as indicated in the comment. (14 Marks)

```
/**
* The VideoTape class holds information about a single television programme
*recorded on *video tape
* and it is used in a video shop system. It holds the video tape details.
*/

public class VideoTape
{
private String title; // the title of the programme
private String classification; // classification of the programme (comedy,
drama, action, or romance)
private int time; // the running time of the programme in minutes

// Create a new video tape with a given title, classification, and time.
public VideoTape (String fullTitle, String programClassification, int
runningTime )
{
title = fullTitle;
classification = programClassification;
time = runningTime;
}
```

i. Return the title of this video tape.

.....

ii. Return the classification of this video tape.

.....

iii. Return the time of this video tape as a string in the following format: 2:06

.....

iv. Set a new classification for this video tape.

.....

v. Print the details of the video tape to the output terminal in the following format:

// Adil Emam(COMEDY) 2:16

Question 04 (20 Marks)

A student registration system ina private educational institute requites a class called ***Course.*** A course has a course *identity number, couse name,* and the *number of hours* the course operates in a week. The *hourly fee* should also be recorded.This hourly fee is same for every object of the class Course.

When course object is created, the identity number, name and hours per week should be set. Relevant class methods (get and set) are required to handle the attributes course name and number of hours. A method that calculates and returns the total weekly cost (number of hours x hourly fee) of the course is also required.

i. Implement the class Course. Include all the appropriate variables and methords required according to the above description. (06 Marks)

ii. A program has the following variables declared:

```
String c_ID;
String c_name;
int hoursPerWeek;
```

Write a fragment of code to be included in this program that obtains the course identity number, name and number of hours per week from a user (through the cosole screen) and creates a new Course object. (08 Marks)

iii. Write a line of code that will output (on a console screen) the total weekly cost of the course for the Course object defined in (ii). (06 Marks)

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Question 05 (20 Marks)

(a) Write a java class to represent the class given below. You should demonstrate your knowledge on OOP concepts. Assume that you cannot reserve a book which is available (not borrowed by another member) in the library. A member cannot borrow a book that has been reserved by another member already.

Book
String title String isbn String author boolean reserved boolean borrowed
Book (String t, String I, String a) reserve( ) borrow( )

Question 06 (04*5=20 Marks)

Explain followings. Use simple example partial codes only if necessary.

(a) Explain the difference between Abstract class and interface.

(b) Explain how parent and child classes are related to base and derived classes.

(c) Explain the difference between method overloading and method overriding.

(d) Can we overload a static method in Java. Justify.

Question 07 (20 Marks)

(a) Mention two types of error you encounter in Java. (02 Marks)

(b) Give at least one example for each category. (02 Marks)

(c) What is the difference between the throw and throws keyword in Java. (04 Marks)

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(d) Provide some Java Exception Handling Best practices? (04 Marks)

(e) Following code would generate an Exception. (08 Marks)

```
public class Error02{
   public static void main(String args[]){
      String s = null;
      System.out.println("Length of the string = "+s.length());
   }
}
```

i. What is the Exception?
ii. Extend the code above to handle the Exception using a try-catch block.

Question 08 (20 Marks)

(a) Describe two (02) advantages of performing Thread-based multitasking compared to Process- based multitasking. (Describe in details) (02 Marks)

(b) Mention three(03) methods that you are using to control Thread. (03 Marks)

(c) Mention one difference between a Deadlock and s Starvation. (03 Marks)

(d) What is meant by thread synchronization? (04 Marks)

(e) Why do we need to synchronize threads? (04 Marks)

(f) Name two (02) approaches used in Java to synchronize threads. (04 Marks)

----------END OF THE QUESTION PAPER----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Advanced Data Structure and Algorithms- IT2107

- There are EIGHT (08) questions in this paper.
- This paper contains five (05) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

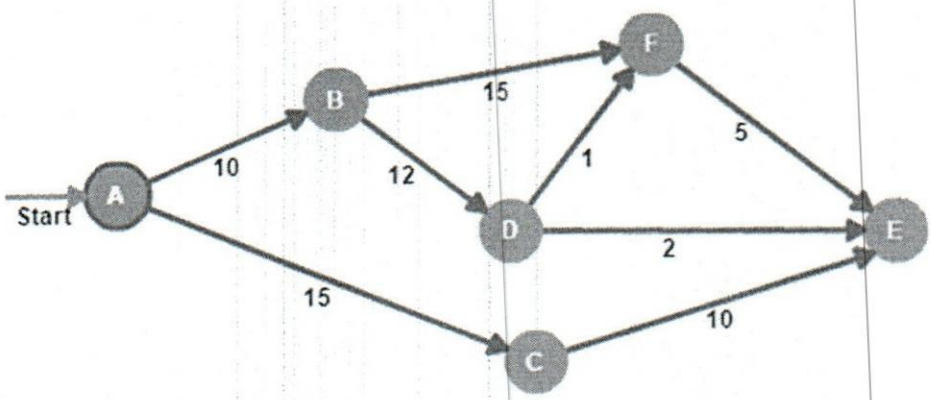
Date: 2022.11.18 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

(a) What is "Greedy Algorithm"? Explain (05 Marks)

(b) State the purpose of Designing Algorithms in SDLC. (05 Marks)

(c) Calculate the Shortest Path from " A – F" Using Dijstra Algorithm. (10 Marks)



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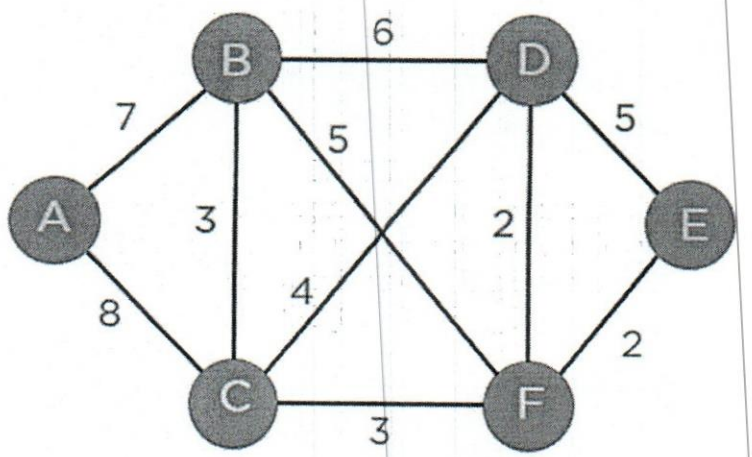
Question 02

(20 Marks)

(a) Calculate the Weight of minimum spanning tree using " Kruskal Algorithm". (10 Marks)



(b) Explain "Priority Queue" Using examples. (10 Marks)

Question 03

(20 Marks)

(a) What is "Graph Algorithm"? Explain. (05 Marks)

(b) Explain following graphs by drawing visual Illustrations of each. (15 Marks)

i. Single Graph
ii. Trivial Graph
iii. Infinite Graph

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Question 04 (20 Marks)

(a) Do a comparison between Heaps and Binary Heaps. Use three (03) points. (03 Marks)

(b) Write five (05) Properties of Algorithm (05 Marks)

(c) Write Applications of following Data Structures (10 Marks)

i. Array
ii. Stack
iii. Queue
iv. Linked List
v. Heaps

(d) What is "Recurrence" in Maths? Explain (02 Marks)

Question 05 (20 Marks)

(a) What is "Hash Table"? (04 Marks)

(b) What is "Collision "? Explain. (06 Marks)

(c) Write an example to avoid the "Collision" using a standard technique. Use Diagrams to support the answer. (10 Marks)

Question 06 (20 Marks)

(a) Explain Following Concepts (06 Marks)

- Multi Dimensional Array
- Max Heap
- Min Heap

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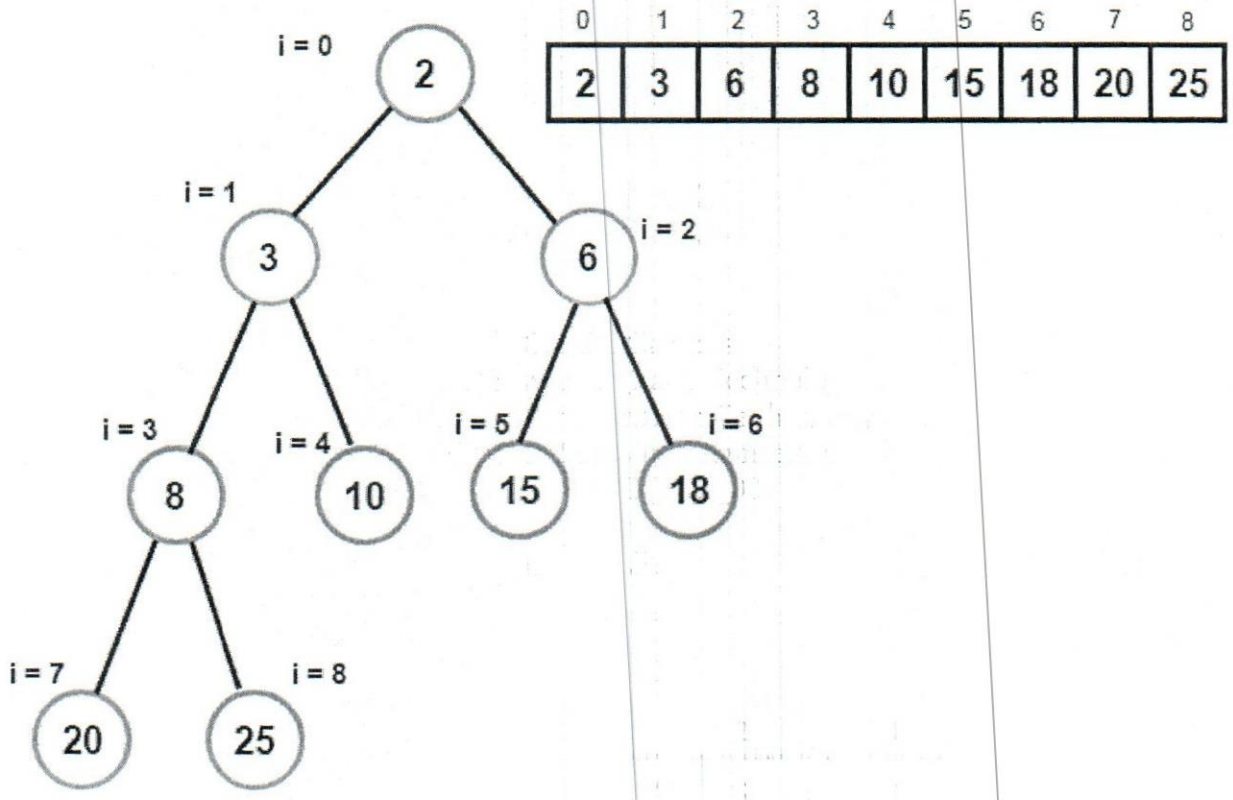
(b) Re arrange the below in to MAX HEAP. (14 Marks)



Question 07 (20 Marks)

(a) What is Web Page Ranking? Explain (05 Marks)

(b) Identify two(02) issues in Web Page Ranking (05 Marks)

(c) Write the Mathematical Formula for Original Page rank and explain (10 Marks)

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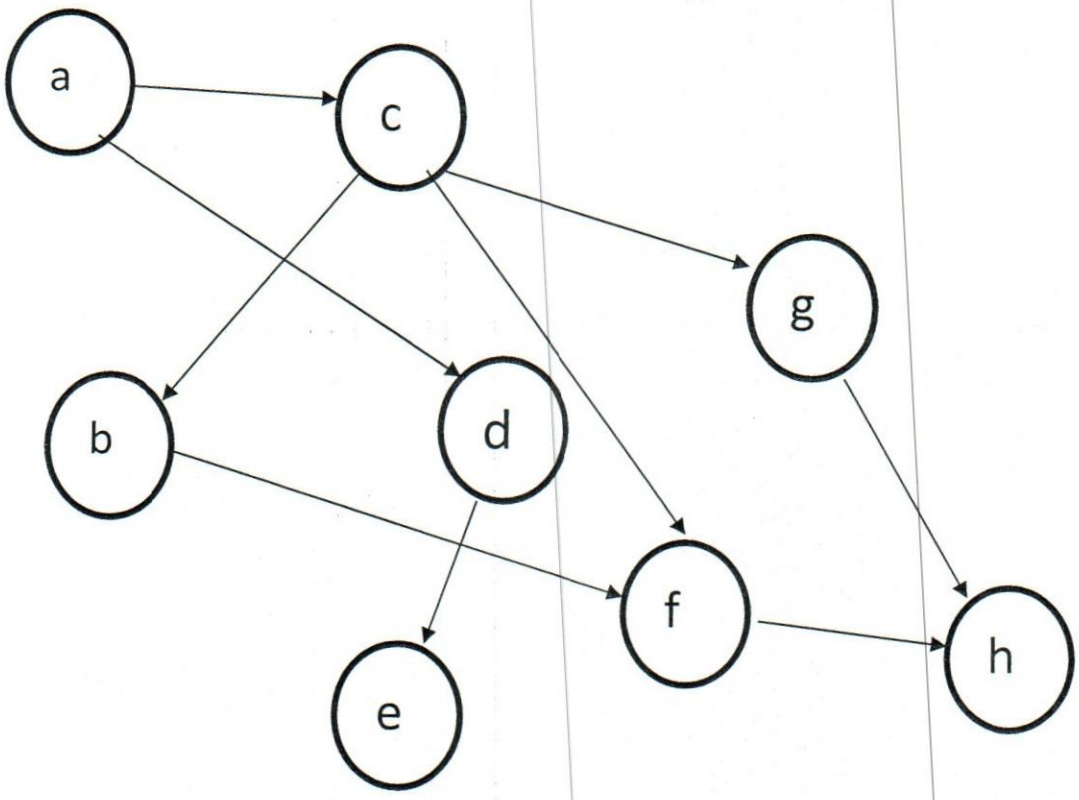
Question 08

(20 Marks)

(a) Divide the below graph in to clusters, using SNN (20 Marks)



----------END OF THE QUESTION PAPER----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Probability and Statistics- GS2105

- There are EIGHT (08) questions in this paper.
- This paper contains eight (08) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.
- Standard normal distribution table and Chi-square distribution are given as Annex 01 and Annex 02 at the end of the paper.

Date: 2022.11.14 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

1. Define the following terms in the field of probability with a suitable example.
   a. Sample space
   b. Random experiment
   c. Trial
   d. Event (08 Marks)

2. A lot of 10 components contains 3 that are defective. Two components are drawn at random and tested. Let A be the event that the first component drawn is defective, and let B be the event that the second component drawn is defective.
   a. Find P(A).
   b. Find P(B | A).
   c. Find P(A ∩ B).
   d. Find P(A′∩ B).
   e. Find P(B).
   f. Are A and B independent? Explain. (12 Marks)

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Question 02 (20 Marks)

1. State the equation used to calculate the probabilities of a binomial distribution. (02 Marks)

2. On average, 5% of the motors produced by a machine are faulty. A random sample of 5 motors is selected from a large batch. Determine the probabilities that
   a. 1 motor is faulty
   b. 2 motors are faulty
   c. 3 motors are faulty
   d. 4 motors are faulty
   e. All are not faulty
   f. At least four motors are not faulty (12 Marks)

3. The Poisson distribution is given by the following equation with the usual notation.

$$P(X = x) = \frac{e^{-\mu}\mu^{x}}{x!} \; for \; x = 1,2,3, \ldots.$$

   In a certain factory producing calculators, there is a small chance of 1 in 500 calculators to be defective. The calculators are supplied in lots of 10. Using Poisson distribution, calculate the approximate number of lots containing
   a. No defective calculators
   b. One defective calculator

   in a consignment of 10,000 lots. (06 Marks)

Question 03 (20 Marks)

1. State four real world examples/distributions which follows the normal distribution. (04 Marks)

2. If $X \sim N(2, 9)$, compute
   a. $P(x \geq 2)$
   b. $P(1 \leq x \leq 7)$
   c. $P(-2.5 \leq x \leq -1)$
   d. $P(x \leq 3)$ (10 Marks)

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3. The lifetime of a battery is normally distributed with mean $\mu = 16$ hours and standard deviation $\sigma = 2$ hours.
   a. What is the probability that a battery will last more than 19 hours?
   b. A particular battery lasts 14.5 hours. What percentile is its lifetime on?
   c. What is the probability that the lifetime of a battery is between 14.5 and 19 hours? (06 Marks)

Question 04 (20 Marks)

1. Let X is a random variable whose distribution is exponential with parameter λ. It is denoted as $X \sim Exp(\lambda)$. The probability density function of the exponential distribution with parameter $\lambda > 0$ is defined as follows.

$$f(x) = \begin{cases} \lambda e^{-\lambda x} & x > 0 \\ 0 & x \leq 0 \end{cases}$$

Show that the cumulative distribution function [F(x)] of $X \sim Exp(\lambda)$ is equal to the following.

$$F(x) = P(X \leq x) = \begin{cases} 1 - e^{-\lambda x} & x > 0 \\ 0 & x \leq 0 \end{cases}$$

(05 Marks)

2. State the mean and variance of $X \sim Exp(\lambda)$ in terms of λ. (02 Marks)

3. A catalyst researcher states that the diameters, in microns, of the pores in a new product he has made have the exponential distribution with parameter $\lambda = 0.25$.
   a. What is the mean pore diameter?
   b. What is the variation of the pore diameters?
   c. What proportion of the pores are less than 3 microns in diameter?
   d. What proportion of the pores are greater than 11 microns in diameter?
   e. What is the median pore diameter? f. What is the third quartile of the pore diameters?

(13 Marks)

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Question 05 (20 Marks)

1. Define the following terms used in the field of Sampling distribution.
   a. Population
   b. Sample
   c. Sampling
   d. Parameter
   e. Statistic
   (05 Marks)

2. Let the population be infinitely large and having a population mean of μ. If x is a random variable denoting the measurement of the characteristic, then show that the expected value of sample mean, $E(\bar{x}) = \mu$.
   (03 Marks)

3. An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a random sample of 16 bulbs will have an average life of
   a. Less than 780 hours.
   b. Between 780 and 810 hours
   c. Greater than 825 hours
   (12 Marks)

Question 06 (20 Marks)

1. Define the terms "Hypothesis" and "Hypothesis test". (02 Marks)
2. Clearly state the steps of Hypothesis testing. (04 Marks)
3. A scale is to be calibrated by weighing a 1000 g test weight 60 times. The 60 scale readings have mean 1000.6 g and standard deviation 2 g. Check whether the scale is needed to recalibrate at 95% confidence.
   (07 Marks)
4. In a test to compare the effectiveness of two drugs designed to lower cholesterol levels, 75 randomly selected patients were given drug A and 100 randomly selected patients were given drug B. Those given drug A reduced their

cholesterol levels by an average of 40 with a standard deviation of 12, and those given drug B reduced their levels by an average of 42 with a standard deviation of 15. The units are milligrams of cholesterol per deciliter of blood serum.

Can you conclude that the mean reduction using drug B is greater than that of drug A? (07 Marks)

Question 07 (20 Marks)

1. Draw a simple sketch to show the shape of Chi-Square distribution for different values of υ ($\upsilon = 1,3,5,10$). (04 Marks)

2. The weight of 100 students in a school is measured. The results obtained are summarized in the following table. (Q7: Table 01). The weight in kgs(kilo grams) is denoted by the random variable X.

X	<35	35-45	45-55	55-65	65<
Observed Frequency	14	22	27	20	17

Q7: Table 01

   a. Assuming that X is modelled by a $N(50, 15^2)$ distribution, calculate the expected frequencies for each of the five classes. (10 Marks)

   b. Carry out a Chi-Square goodness of fit analysis to test at the 5% level, the hypothesis that X can be modelled as $N(50, 15^2)$ distribution. (06 Marks)

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Question 08 (20 Marks)

1. Find the regression line of y on x for the following data. (17 Marks)

x	1	2	3	5	6	9	10	12
y	1	2	6	7	7	8	12	13

Q8: Table 01

Estimate the values of y, when x = 4, x = 7 and x = 15. (03 Marks)

[Hint: With usual notations, you can use the relationship $\sum y = na + b\sum x$ and $\sum xy = a\sum x + b\sum x^2$ directly]

----------END OF THE QUESTION PAPER----------

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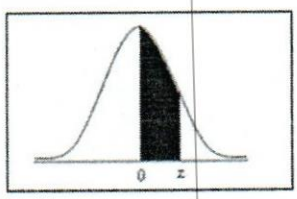
Annex 01: Standard Normal Distribution Table

Standard Normal Distribution Table

The table entries represent the area under the standard normal curve from 0 to the specified value of z.



	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0	0.004	0.008	0.012	0.016	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.091	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.148	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.17	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.195	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.219	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.258	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.291	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.334	0.3365	0.3389
1	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.377	0.379	0.381	0.383
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.398	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.437	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.475	0.4756	0.4761	0.4767
2	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.483	0.4834	0.4838	0.4842	0.4846	0.485	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.489
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.492	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.494	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.496	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.497	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.498	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.499	0.499

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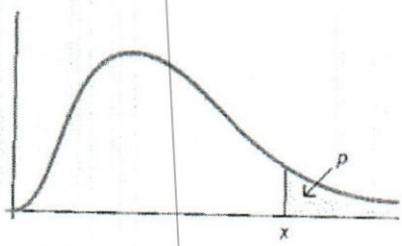
Annex 02: Chi-Square Table

CRITICAL VALUES FOR THE χ^2 DISTRIBUTION

If X has a χ^2 distribution with v degrees of freedom, then for each pair of values of p and v, the table gives the value of x such that $P(X \geq x) = p$



p	0.990	0.975	0.950	0.100	0.050	0.025	0.010	0.005
$v = 1$	0.000	0.001	0.004	2.705	3.841	5.024	6.635	7.879
2	0.020	0.051	0.103	4.605	5.991	7.378	9.210	10.597
3	0.115	0.216	0.352	6.251	7.815	9.348	11.345	12.838
4	0.297	0.484	0.711	7.779	9.488	11.143	13.277	14.860
5	0.554	0.831	1.145	9.236	11.070	12.832	15.086	16.750
6	0.872	1.237	1.635					

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Year 2 Semester 1

SEMESTER END EXAMINATION

Operating Systems- IT2106

- There are EIGHT (08) questions in this paper.
- This paper contains five (05) pages.
- Excluding the Compulsory question-answer any four (04) questions. Overall five (05) questions should be answered. Do not answer any extra questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.11.16 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

Every computer system must have at least one operating system to run other programs. Operating System or OS helps users to communicate with the computer without knowing how to speak the computer's language. It is not possible for the user to use any computer or mobile device without having an operating system.

(a) State two (02) types of OS.

(02 Marks)

(b) Compare and contrast ROM and RAM with respect to three (03) factors.

(03 Marks)

(c) Consider the set of 4 processes whose arrival time and burst time are given below-

(05 Marks)

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(d) Briefly explain what a firewall is and how it could protect a system.

(06 Marks)

Process No.	Arrival Time	Burst Time
P0	0	7
P1	1	3
P2	3	4
P3	2	1

Question 08 (20 Marks)

(a) Define the terms "preemptive" and "non-preemptive" scheduling.

(04 Marks)

(b) State all CPU scheduling policies. If the CPU scheduling policy is Shortest Remaining Time First (SRTF), draw the Gantt chart and then calculate the "average waiting time" and "average turnaround time".

(d) Write a comprehensive description about architectures of OS, explaining about different architectures, their advantages and disadvantages and how it has evolved from one architecture to another to reach the current OS architectures.

(10 Marks)

Question 02 (20 Marks)

(a) State three (03) types of I/O channels.

(03 Marks)

(b) Briefly describe the relationships between operating systems and the hardware.

(04 Marks)

(c) Draw a detailed diagram to explain how CPU switch from process to process.

(05 Marks)

(d) Draw a complete process state diagram.

(08 Marks)

Question 03 (20 Marks)

(a) State four (04) information that are stored in a process control block.

(04 Marks)

(b) Define the terms "CPU scheduler" and "dispatcher".

(05 Marks)

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(c) State all options for resource sharing and execution in between parent and child processes. (05 Marks)

(d) Draw diagrams for the three multithreading models and name them correctly.

(06 Marks)

Question 04 (20 Marks)

(a) State three (03) the differences between physical and virtual memory.

(03 Marks)

(b) State three (03) methods of dynamic memory allocation. (Ways to satisfy a request of size n from a list of free holes)

(03 Marks)

(c) Draw diagrams for RAID levels 0 and 1.

(04 Marks)

(d) Draw a diagram to depict how paging hardware works with translation look aside buffer (TLB).

(04 Marks)

(e) Write definitions for the following terms.

1.Static linking
2.Swapping
3.Memory management unit (MMU)

(06 Marks)

Question 05 (20 Marks)

(a) Define the term "file" and give two (02) examples for files that are used in the OS.

(04 Marks)

(b) Differentiate in between "network attached storage (NAS)" and "storage area network (SAN)". You may use diagrams if needed.

(04 Marks)

(c) State six (06) attributes of a file and state their purpose.

(06 Marks)

(d) Define the terms "sequential access" and "random access". Illustrate the two access methods with diagrams.

(06 Marks)

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Question 06 (20 Marks)

(a) State three (03) symptoms of a computer viruses.

(03 Marks)

(b) Define the term "deadlock" and provide a simple example using a resource allocation graph.

(05 Marks)

(c) Write short notes for the following security violation categories in a computer system.

1. Breach of confidentiality
2. Breach of integrity
3. DDos (Distributed Denial of service) attacks

(06 Marks)

(d) Write an explanation about bounded-buffer problem in synchronization.

(06 Marks)

Question 07 (20 Marks)

(a) State three (03) unfavorable situations happening when processes are not properly synchronized.

(03 Marks)

(b) Illustrate with a diagram how a secure communication can be done over an insecure medium using symmetric key encryption/decryption.

(05 Marks)

(c) Briefly define what a "semaphore" is and define the two types of semaphores.

(06 Marks)

(d) Briefly explain what a firewall is and how it is used to protect a system.

(06 Marks)

Question 08 (20 Marks)

(a) Define the terms "preemptive" and "non-preemptive" scheduling.

(04 Marks)

(b) State all CPU scheduling criteria and state the optimized condition for each.

(05 Marks)

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(c) Draw the Gantt chart for SJF scheduling (preemptive) and calculate the average waiting time. (Marks will be given for the steps, hence show value calculations for each process)

Process	Arrival time	Burst time
P0	0	6
P1	1	4
P2	2	2
P3	3	3

(05 Marks)

(d) Draw the Gantt chart for FCFS scheduling and for Round Robin (2 ms Quantum).

For the Round Robin consider that all processes arrive at the same time when clock says 0.

Then calculate the average waiting time for both scheduling methods. (Marks will be given for the steps, hence show value calculations for each process)

Process	Arrival time	Burst time
P1	0	4
P2	1	6
P3	2	5
P4	3	2

(06 Marks)

----------END OF THE QUESTION PAPER----------

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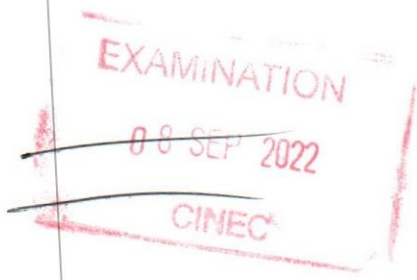

Year 2 Semester 1

SEMESTER MID EXAMINATION

Object Oriented Concepts & Programming – IT2108

- This is a MCQ paper.
- There are twenty (20) questions and the paper contains eight (08) pages.
- Students should provide answers to all the questions.

Date: 08/09/2022

Time: 01 Hour

Underline the correct answer/s. Five (05) marks for each MCQ question.

1. What is NOT TRUE about Java Language?

   a) Java was designed to write programs for home appliances.

   b) The look and feel of Java was adopted from C++

   c) Java became popular due to the influence of WWW.

   d) Java programs were considered as unsuitable for the heterogeneous environment in WWW.

2. What is the INCORRECT statement?

   a) JVM is the environment provided for Java programs to run.

   b) You may import any number of classes and it will not increase the size of the byte code, since the linking is done at runtime by the JVM.

   c) If you allocate memory in a Java program, you must de-allocate them. Other wise no other program will be able to use those memory areas.

   d) Bytecode contains the machine code for the Java Virtual Machine.

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3. Select the CORRECT declaration statement.

a) integer i=35;

b) final static int TOTAL;

c) float f = (double)2.34;

d) int a =32.54;

4. What will be the output of the following code?

```
int i = 10;
System.out.println( i & i);
System.out.println( i | i);
System.out.println( i ^ i);
```

a) 10, 10 and 0

b) 10,10 and 10

c) 0,10 and 0

d) 10,0 and 0

5. What will be the output of the following code?

```
int i = 12;
System.out.println(--i);
i++;
System.out.println(i++);
System.out.println(++i);
```

a) 12, 12 and 12

b) 11, 12 and 14

c) 12, 13 and 14

d) 11, 12 and 12

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6. What is TRUE about the following if statement?

```
int i = 12;
if (i>75)
        System.out.println("Excelent");
elsif (i>50)
        System.out.println("Good");
else
        System.out.println("General");
```

a) Always generate the output as 'General'.

b) Generate compile errors since we have not used braces (curly brackets) properly in the if statement.

c) Generate no compile error or no runtime errors and run properly.

d) Generate a compile error since we do not have a keyword called 'elsif'.

7. With reference to the following if-else statement, what is the CORRECT equivalent statement written using conditional (ternary) operator?

```
if (days<5)
        fine = 1000;
else {
        if (days<14)
                fine = 1000 + ( days-5)*100;
        else
                fine = 2500 + ( days-14)*200;
}
```

a) fine = (days >5)? 1000: ((days>14)?(1000+(days-5)*100):(2500+(days-14)*200));

b) fine = (days <5)? 1000: ((days<14)?(1000+(days-5)*100):(2500+(days-14)*200));

c) fine = (days <14)? 1000: ((days<5)?(1000+(days-5)*100):(2500+(days-14)*200));

d) fine = (days <5)? ((days>14)?(1000+(days-5)*100):(2500+(days-14)*200)) :1000;

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8. What is NOT TRUE about the following statement?

```
while (amount>=0)
        total = total + amount;
        amount--;
```

a) The loop will terminate when the amount become less than zero.

b) The loop may not run at all or it may be a never ending loop.

c) Within the loop body we perform actions to make the conditional statement in the while statement to become false.

d) Once the while loop is over, the value of the variable 'amount' will be reduced by one.

9. With relevant to the code given below which statement would generate a TRUE value?

```
String s1, s2, s3;
s1 = "Java is Fun!";
s2 = new String("Java");
s3 = "JAVA IS FUN!";
```

a) (Character.isDigit(s1.charAt(2)))

b) (s1 ==s2)

c) (s1.substring(0,4).equals(s2))

d) (s1.compareToIgnoreCase(s3) !=0)

10. What is NOT an advantage of OO Programming?

a) A program can be easily extended by adding new classes attribute and methods.
b) Can execute programs in any platform since the bytecode is platform independent.
c) Saving time and high productivity through reusability.
d) Secure programs through data hiding.

11. What is the INCORRECT statement?

a) A class represents a similar set of entities but an object represents exactly one entity.
b) A class is a description, the objects follow that description.
c) The child cannot access protected content of the parent if the child is in a different package.
d) Members of a class can be defined as public , protected, default or private; but a class is not allowed to be defined as protected or private.

12. What is NOT TRUE about the constructors in JAVA?

a) The duty of the constructor is to initialize the object and the constructor will be executed only once for the lifetime of an object.
b) *this()* refers to a constructor in the same class and we can use it only within a constructor of a class. Further it must be the first line of the constructor.
c) The children will never inherit the constructors of the parent. If we create an object of a child the constructor belong to the parent runs first and the constructor belongs to the child runs at last.

d) A grand child can call a constructor belongs to the grand parent by using **super.super().**

13. What is NOT TRUE about inheritance?

a) A super class variable can refer to a child class object since any sub class object is-a super class object.
b) Child inherits all the attribute and methods from the parent including all private content.
c) Super class object is small but a child class object is large.
d) Super class is an abstract form and the child is a detailed form.

14. What is NOT TRUE about polymorphism in Java?

a) The meaning of the word polymorphism is 'many form'
b) Polymorphism allows us to use the same look and feel for different number of actions.
c) Method overriding is called as dynamic distributed function call.
d) In general inheritance, polymorphism and dynamic binding exist together.

15. What is the INCORRECT statement?

a) A final method must have a method body and the children cannot override a final method of the parent.
b) A class that can be instantiated is called a concrete class. A method that can be invoked is called a concrete method.
c) An interface is a pure Java class which can be instantiated.

d) Static nested classes are randomly used since they cannot access the members of outer class directly.

16. What will be the output of the following code.

```
int i = 10;
System.out.println( i <<32);
```

a) 10

b) $10/2^{32}$

c) $10*2^{32}$

d) 0

17. What will be the output of the following code?

```
System.out.println( 8 & 4);
```

a) 8

b) 4

c) 0

d) 12

18. What will be the output of the following code?

```
System.out.println("Hannah\t5 1/8 '\t7");
```

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a) Hannah\t5 1/8't7
b) Hannaht5'18 t7
c) Hannah 5 1/8 7
d) Hannah 5 18' 7

19. What is NOT TRUE about access modifiers in Java?

a) Private protected content is accessible within the class, within the package and within sub classes.
b) Even a child cannot access private content of a parent.
c) All class variable of class should be private. We will not select any other access level without having a good reason.
d) Protected class dose not give a meaning. So protected classes are not allowed.

20. Any protected component?

a) Cannot be accessed within the class
b) Cannot be accessed within the package
c) Cannot be accessed by the subclasses
d) Cannot be accessed from anywhere outside

----------*END OF THE QUESTION PAPER*----------

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Year 2 Semester 1

SEMESTER MID EXAMINATION

Advanced Data Structures and Algorithms – IT2107

- There are two (02) questions and the paper contains two (02) pages.
- Students should provide answers to all the questions.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 08/09/2022 Time: 01 Hour

Question 01 (10 Marks)

I. Explain about Algorithms and mention three (03) Characteristics of Algorithms. (04 Marks)

II. Explain "Collision" with a proper example (03 Marks)

III. Write three (03) Techniques to Avoid the Collision. (03 Marks)

Question 2 (10 Marks)

I. Explain the Usage of Data Structures in Programming. Use sample code to support your Answer. (03 Marks)

II. Name one (01) Real world Application each for below mentioned Data Structures.
- Array
- Stack
- Queue

(03 Marks)

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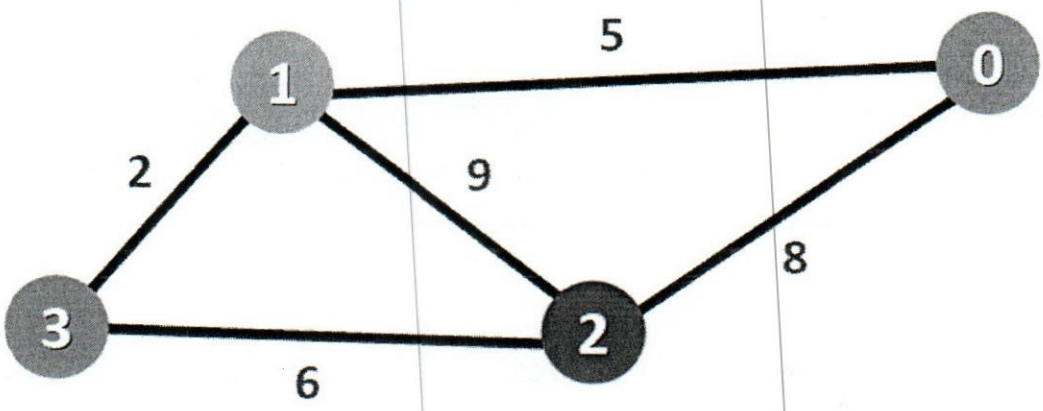
III. Calculate and find the shortest path from 3 to 0. (04 Marks)



----------END OF THE QUESTION PAPER----------

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Year 2 Semester 1

SEMESTER MID EXAMINATION

Probability and Statistics – GS2105

- There are four (04) questions and the paper contains three (03) pages.
- Students should provide answers to all the questions.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 06/09/2022 Time: 01 Hour

Question 01 (25 Marks)

I. Let $y_i = \frac{x_i}{k}$ Where $k \neq 0$ and i=1,2,……,n Show that:

a. $\bar{y} = \frac{\bar{x}}{k}$ where $\bar{y}$ and $\bar{x}$ represent the mean values of y_i and x_i respectively.

b. $s_y = \frac{s_x}{|k|}$ where s_y and s_x represent the standard deviation (SD) of yi and xi respectively.

(Note : $|a| = \sqrt{x^2}$)

(15 Marks)

II. The marks of an examination are given by the following data:

12, 27, 13, 21, 36, 56, 53, 55, 59, 83, 92, 75, 67, 80, 91, 99, 84 and 77.

Evaluate the standard deviation for this data.

(10 Marks)

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Question 02

(25 Marks)

I. From the following frequency distribution, compute the standard deviation of 100 students:

Mass in kg	60-62	63-65	66-68	69-71	72-74
Number of students	5	18	42	27	8

(10 Marks)

II. Find the mode from the following data:

Age	0-6	6-12	12-18	18-24	24-30	30-36	36-42
Frequency	6	11	25	35	18	12	6

(15 Marks)

Question 03

(25 Marks)

I. An amplifier consists of two independent stages, A and B, connected in series (Fig. a). The output of Ais the input to B. The amplifier works if both stages A and B work. If the probability of A working is 0.72 and the probability of the amplifier working is 0.61, then find the probability that stage B works, given that stage A works.

Fig a.

(10 Marks)

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II. There are 6 positive and 8 negative numbers. Four numbers are chosen at random, without replacement, and multiplied. What is the probability that the product is a positive number?

(15 Marks)

Question 04

(25 Marks)

I. State bayes theorem

(05 Marks)

II. Three persons A, B and C have applied for a job in a private company. The chance of their selections is in the ratio 1 : 2 : 4. The probabilities that A, B and C can introduce changes to improve the profits of the company are 0.8, 0.5 and 0.3, respectively. If the change does not take place, find the probability that it is due to the appointment of C.

(20 Marks)

----------*END OF THE QUESTION PAPER*----------

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Year 2 Semester 1

SEMESTER MID EXAMINATION

Operating Systems – IT2106

- There are ten (10) MCQ and one (01) structured questions and the paper contains five (05) pages.
- Students should provide answers to all the questions and containing fifty (50) marks in total.
- Answers should be only provided in English.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 06/09/2022 Time: 01 Hour

Question 01 (10 Marks)

Select the most suitable answer (single choice) among the given answers and underline the answer.

(10 x 1 = 10) Marks

1. Operating systems

   (a) Provides a layer so as to act as a user-friendly interface that enables the programmer to draw a flow chart. It acts as an interface between the user.
   (b) Links the program with subroutines
   (c) Helps to create a flow chart of the programs
   (d) All of these

2. Which of the following are CPU scheduling algorithms?

   (a) Priority scheduling
   (b) Round Robin
   (c) Shortest Job First
   (d) All of the above

3. Thread is a

   (a) Light weight process
   (b) Heavy weight process
   (c) Multi-process
   (d) I/0 process

4. Which of the following is not a purpose of an OS.

   (a) Provide user interfaces
   (b) Manage program execution
   (c) Control I/O operations
   (d) Database management

5. Which one of the following is not true?

   (a) kernel remains in the memory during the entire computer session
   (b) kernel is made of various modules which cannot be loaded in running operating system
   (c) kernel is the first part of the operating system to load into memory during booting
   (d) kernel is the program that constitutes the central core of the operating system

6. Which of the following is not an operating system?

   (a) UNIX
   (b) MS-DOS
   (c) UBUNTU
   (d) PASCAL

7. OS classifies the threads as-

   (a) Mainframe and motherboard level
   (b) Kernel and User level
   (c) Security and Memory level
   (d) OS and CPU level

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8. What is the name of the operating system that reads and reacts in terms of actual time?

   (a) Real time system
   (b) Time sharing system
   (c) Quick response system
   (d) Batch system

9. What is meant by ready state of a process?

   a) when process is scheduled to run after some execution
   b) when process is unable to run until some task has been completed
   c) when process is using the CPU
   d) none of the mentioned

10. Among the following CPU scheduling algorithms, which of these allocated the CPU first to the process that requests the CPU first?

    (a) FCFS
    (b) SJF
    (c) Priority scheduling
    (d) None

Question 02 (40 Marks)

1. Briefly explain monolithic and microkernel architectures with the support of diagrams.
   (14 Marks)
2. State five (05) information associated with a process which is stored in the PCB.
   (10 Marks)
3. State three (03) options for resource sharing among parent and children processes.
   (06 Marks)

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4. Consider the following table of arrival time and burst time for three processes P0, P1, P2 and P3.

Process	Arrival time	Burst Time
P0	0 ms	8 ms
P1	1 ms	4 ms
P2	3 ms	1 ms
P3	2 ms	5 ms

If the pre-emptive shortest job first scheduling algorithm (SRTF) is used, what is the average waiting time and average turnaround time for the three processes? Draw a Gantt chart.

(10 Marks)

----------*END OF THE QUESTION PAPER*----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Software Architecture and Design- SE2102

- There are EIGHT (08) questions in this paper.
- This paper contains four (04) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.05.31 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

Describe Two (02) disadvantages of the waterfall life cycle model. (02 Marks)

(b) What are the activities of the generic software process? (05 Marks)

(c) What is a CASE tool? Provide three (03) examples of CASE tools. (05 Marks)

(d) Describe Process Quality and Product Quality in software development. Give two quality attributes each for product quality and process quality.

(08 Marks)

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Question 02 (20 Marks)

Consider a software system which has designed for a restaurant to handle the orders of the customers. The system should allow the waiters to handle customers' orders by adding them, canceling them, and scheduling parts of the order.

Scheduling parts of the order includes sending the starters (appetizers) and the main course (main meal) to the customers separately. The cashier should be allowed to let customers pay for their meals, and print receipts.

(a) List three (03) functional and two (02) non-functional requirements of the above system in correct format. (05 Marks)

(b) Draw the use case diagram for the restaurant ordering system and give the use case detailed description for the use case "CancelOrder". (15 Marks)

Question 03 (20 Marks)

(a) Define the term "Software Design". (02 Marks)

(b) Explain Briefly the importance of Software Design phase in Software development life cycle. (08 Marks)

(c) Describe the difference between a "class" and an "instance". Show typical examples of each as they would be represented in UML diagrams and in source code. (10 Marks)

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Question 04 (20 Marks)

(a) Write any two characteristics of software as a product. (02 Marks)

(b) Explain Briefly "Component-Level Design elements" and "Deployment-Level Design elements. (08 Marks)

(c) When designing software components, "coupling" and "cohesion" of components are two important factors which should be considered.

i. Describe these two factors. (06 Marks)

ii. Why it is desirable to have low coupling and high cohesion? (04 Marks)

Question 05 (20 Marks)

(a) What is a Software Design Pattern? (02 Marks)

(b) Write four (04) advantages of using design patterns in software development? (04 Marks)

(c) Name one Design Pattern and describe an application where this pattern can be used. (06 Marks)

(d) Write two categories of "Design Patterns" with two examples for each. (08 Marks)

Question 06 (20 Marks)

(a) Briefly explain five (05) Software "Design Principles" (10 Marks)

(b) The repository model is one of the standard software design models. Explain the repository model together with its advantages and disadvantages. (08 Marks)

(c) Give an example of a system which can be built using the repository model. (02 Marks)

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Question 07 (20 Marks)

(a) Define the term "Software Architecture". (04 Marks)

(b) Briefly explain below systems with one example for each.

i. Event driven systems

ii. Online systems

iii. Real-time systems (06 Marks)

(c) Briefly explain Three Tier client/server architecture with aid of a suitable diagram. (10 Marks)

Question 08 (20 Marks)

Briefly explain the following terms.

(a) Abstraction

(b) Stakeholders

(c) Usability

(d) Architecture Description (05 Marks *4)

----------*END OF THE QUESTION PAPER*----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Object Oriented Concepts & Programming- IT2108

- There are EIGHT (08) questions in this paper.
- This paper contains seven (07) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.05.30 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

(a) What is the difference between a **local variable** and a **field**? (04 Marks)

(b) What is the purpose of keyword **new**? Explain what happens when you use it. (04 Marks)

(c) Explain why a class might provide a **set** method and a **get** method for an instance variable? (04 Marks)

(d) Explain the behavior of static class variables and methods. (04 Marks)

(e) What happens when a return type, even **void,** is specified for a constructor? (04 Marks)

Question 02: (20 Marks)

(a) How does inheritance support software reuse? (02 Marks)

(b) Is polymorphism an essential feature in inheritance? Justify (02 Marks)

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(c) Discuss the output of the following program. State any assumptions that you make. (08 Marks)

```
class Animal {
   private int weight=0;

   public void setWeight(int initWeight)
   {
      weight=initWeight;
   }
   public int getWeight()
   {
      return weight;
   }
   public String says()
   {
      return "Animals can't talk";
   }

}// end class Animal

class Cow extends Animal{
   public String says(){
      return "Moo";
   }
}//end class Cow
```

```
class Pig extends Animal{
   public String says(){
      return "Grunt";
   }
}// end class Pig

public class Test{
   public static void main(String[] args){
      Pig wilber=new Pig();
      Cow daisy=new Cow();

      Animal animal;
      String talk;

      animal=daisy;
      talk=animal.says();
      System.out.println(talk);

      animal=wilber;
      talk=animal.says();
      System.out.println(talk);

   }//end class Test
}
```

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(d) Write a code for class Snake which is inherited from Animal class given in (c) including the following method: (04 Marks)

```
Public String Skin(){
        return "shedding skin";
}
```

(e) Add the following code to the Test class given in (c) and discuss the output: (04 Marks)

```
Animal newAnimal = new Animal();
Snake snake=animal;
System.out.println(snake.Skin());
```

Question 03 (20 Marks)

(a) Explain why a static method cannot refer to an instance variable. (04 Marks)

(b) Why referring to **this** in a static method is a syntax error? (04 Marks)

(c) Why overriding one or more methods of a parent class by its child class is required. (06 Marks)

(d) What is a default constructor? How are instance variables of an object initialized if a class has only a default constructor? (06 Marks)

Question 04 (20 Marks)

Suppose that the **Loan** class is given is shown in the following UML. Write a test program that creates a Loan object with a loan amount of Rs 40000, the annual interest rate of 5.5%, and number of years 15, and displays the monthly payment and total payment. Assume the Loan class is available.

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Loan	
-annualInterestRate: double	The annual interest rate of the loan (default: 2.5).
-numberOfYears: int	The number of years for the loan (default: 1)
-loanAmount: double	The loan amount (default: 1000)..
-loanDate: Date	The date this loan was created.
+Loan()	Constructs a default loan object.
+Loan(annualInterestRate: double, numberOfYears: int, loanAmount: double)	Constructs a loan with specified interest rate, years, and loan amount.
+getAnnualInterestRate(): double	Returns the annual interest rate of this loan.
+getNumberOfYears(): int	Returns the number of the years of this loan.
+getLoanAmount(): double	Returns the amount of this loan.
+getLoanDate(): Date	Returns the date of the creation of this loan.
+setAnnualInterestRate(annualInterestRate: double): void	Sets a new annual interest rate to this loan.
+setNumberOfYears(numberOfYears: int): void	Sets a new number of years to this loan.
+setLoanAmount(loanAmount: double): void	Sets a new amount to this loan.
+monthlyPayment(): double	Returns the monthly payment of this loan.
+totalPayment(): double	Returns the total payment of this loan.

Question 05 (20 Marks)

(a) Create a class called **Date** that includes three instance variables – a month (type **int**), a day (type **int**) and a year (type **int**). Provide a constructor that initializes the three instance variables with correct values. Provide an appropriate set and get method for the catch instance variable. Provide a method **displayDate** that displays the month, day and year separated by the hyphen (-). (12 Marks)

(b) Write a test application named **DateTest** that demonstrates class Date's capabilities. (08 Marks)

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Question 06 (20 Marks)

Explain followings. Use simple example partial codes only if necessary.

(a) Explain what a call to super() does in a constructor of a derived class.

(b) Explain how parent and child classes are related to base and derived classes.

(c) Explain the difference between method overloading and method overriding.

(d) Explain the modifiers public, protected and private.

Question 07 (20 Marks)

(a) Mention two types of Exceptions in Java. (02 Marks)

(b) Give at least one example for each category. (02 Marks)

(c) Mention a difference between the above-mentioned types. (04 Marks)

(d) The code given below will generate a compile error. (06 Marks)

i. What is the error?
ii. Correct the error. (write only the lines which are changing)

```
public class QuestionB{
      public static void main(String[] args){
            int i;
            if (args.length<1)
                  System.out.println("Pass a command line argument!");
            else
                  i = Integer.parseInt(args[0]);
            System.out.println("You enterd an Integer : "+i);
      }
}
```

(e) The following code might generate two Exceptions (06 Marks)

i. What are those?
ii. Extend the code given and handle the Exceptions using a try block and multiple catch blocks

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```
public class QuestionB{
      public static void main(String[] args){
            int n1 = Integer.parseInt(args[0]);
            int n2 = Integer.parseInt(args[1]);

            int sum= n1+n2;
            System.out.println("Result of addition : "+sum);
      }
}
```

Question 08 (20 Marks)

(a) List at least 2 differences between an Applet and Java Application (01 Mark)

(b) List at least 2 important methods in the Applet class, which will be overridden by your implementation. Explain when and where these methods will be invoked.

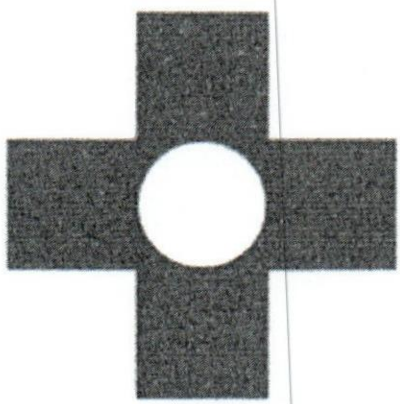
(02 Marks)

(c) Describe the three components available in Java Event handling model.

(03 Marks)

(d) Write a Java Applet to draw the following shape. (14 Marks)

Hint: You may use setColor(), fillRect(), fillOval() methods in Graphics class and BLACK and WHITE attributes in COLOR class.



----------*END OF THE QUESTION PAPER*----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Advanced Data Structure and Algorithms- IT2107

- There are EIGHT (08) questions in this paper.
- This paper contains five (05) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

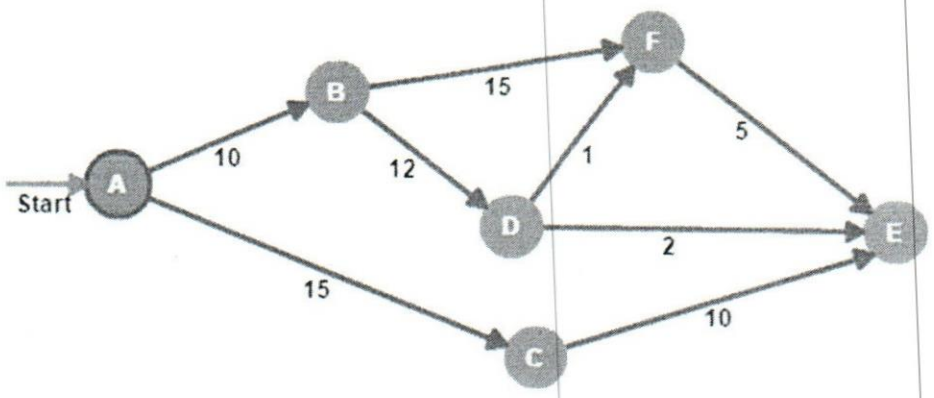
Date: 2022.05.27 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

(a) What is "Shortest Path Algorithm"? Explain (05 Marks)

(b) Name three (03) Real Applications/ Apps which had been developed using the concept" Shortest Path Algorithm" (05 Marks)

(c) Calculate the Shortest Path from " A - E" Using Dijstra Algorithm. (10 Marks)



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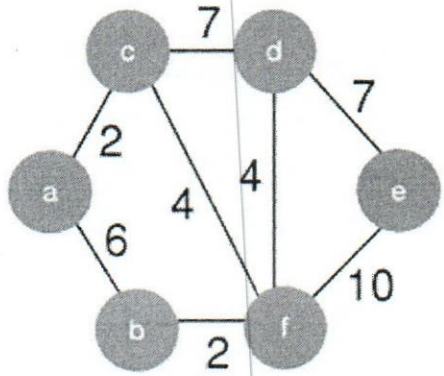
Question 02 (20 Marks)

(a) Calculate the Weight of minimum spanning tree using " Kruskal Algorithm". (10 Marks)



(b) Explain "Minimum Spanning Tree" Using examples. (10 Marks)

Question 03 (20 Marks)

(a) Explain " Graph Algorithm" by giving real world Application of it. (05 Marks)

(b) Explain following graphs by drawing visual Illustrations of each. (15 Marks)

- Single Graph
- Trivial Graph
- Infinite Graph

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Question 04 (20 Marks)

(a) What is an Algorithm? Explain (03 Marks)

(b) Write five (05) Properties of Algorithm (05 Marks)

(c) Write Applications of following Data Structures (10 Marks)

i. Array
ii. Stack
iii. Queue
iv. Priority Queue
v. Heaps

(d) What is "Recurrence" in Maths? Explain (02 Marks)

Question 05 (20 Marks)

(a) What is "Perfect Hashing?" Explain. (04 Marks)

(b) What is "Collision "? Explain. (06 Marks)

(c) Write an example to avoid the " Collision" using a standard technique. Use Diagrams to support the answer.
(10 Marks)

Question 06 (20 Marks)

(a) Explain Following Concepts (06 Marks)

I. Binary Heaps
II. Max Heap
III. Min Heap

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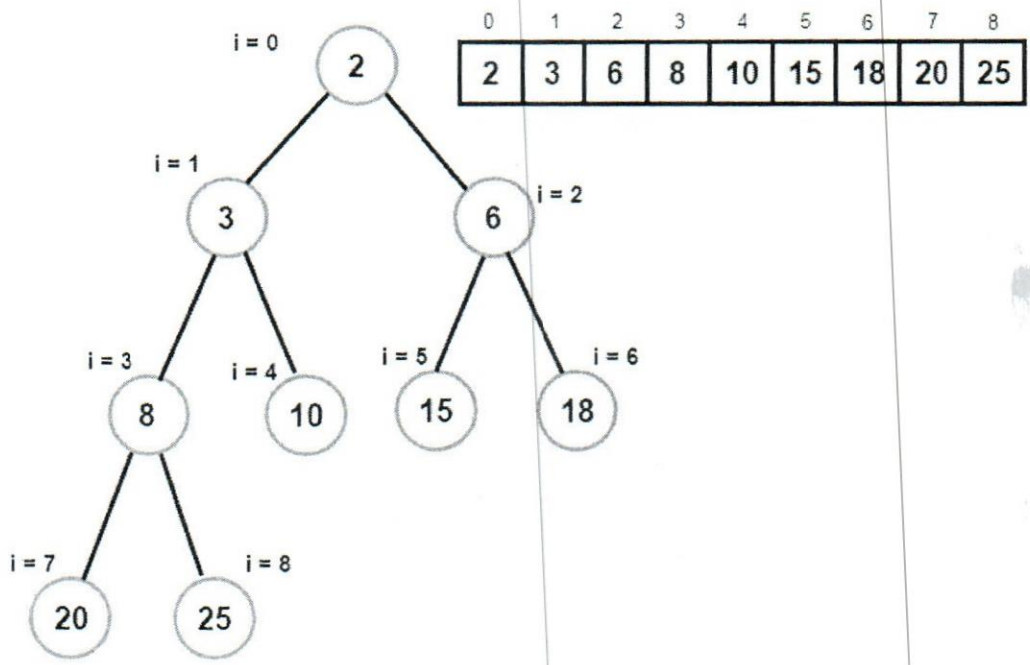
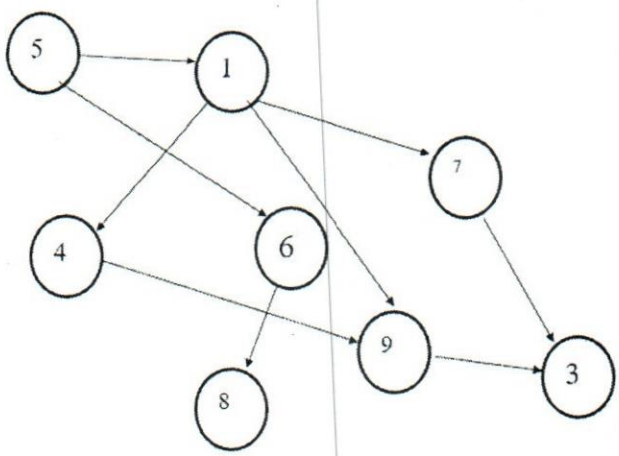
(b) Re arrange the below in to MAX HEAP. (14 Marks)



Question 07 (20 Marks)

(a) Divide the below graph in to clusters, using SNN (20 Marks)



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Question 08 (20 Marks)

(a) What is Web Page Ranking? Explain (05 Marks)

(b) Explain how page rank works in Google search Engine (05 Marks)

(c) Write the Mathematical Formula for Original Page rank and explain. (10 Marks)

----------*END OF THE QUESTION PAPER*----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Operating Systems- IT2106

- There are EIGHT (08) questions in this paper.
- This paper contains five (05) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.05.25 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

An **Operating System (OS)** is a software that acts as an interface between computer hardware components and the user. Every computer system must have at least one operating system to run other programs.

(a) State four (04) services provided by an OS. (02 Marks)

(b) Define what is a "computer virus". (02 Marks)

(c) Compare and contrast virtual and physical memory. (03 Marks)

(d) What is the main difficulty that a programmer must overcome in writing an operating system for a real-time environment? (04 Marks)

(e) What is the main advantage of the layered approach to system design? What are the disadvantages of using the layered approach? (04 Marks)

(f) Consider the set of 4 processes whose arrival time and burst time are given below- (05 Marks)

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Process No.	Arrival Time	Burst Time
P1	0	7
P2	0	7
P3	2	6
P4	5	5

If the CPU scheduling policy is Shortest Remaining Time First, calculate the "average waiting time" and "average turnaround time".

Question 02 (20 Marks)

(a) Write a short note about any type of OS. Your description should include the purpose, application of OS, advantages and disadvantages etc. (04 Marks)

(b) Define what is "Kernel" and explain the purpose of kernel in OS. (04 Marks)

(c) State what is stored in the below fields of process control block (PCB). (04 Marks)

1. Program counter
2. CPU registers
3. CPU scheduling information
4. Memory-management information

(d) Draw a complete process state diagram. (08 Marks)

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Question 03 (20 Marks)

(a) State 4 benefits of multithreading. (04 Marks)

(b) Define the term "parallel computing". State two types of parallelism. (05 Marks)

(c) Draw the diagrams for two communication models in OS. (05 Marks)

(d) Define and compare and contrast "monolithic" and "microkernel" OS architectures. You may use diagrams if needed. (06 Marks)

Question 04 (20 Marks)

(a) What is the purpose of "Cache memory" in a computer? (02 Marks)

(b) State three (03) examples for file systems in OS. (03 Marks)

(c) Differentiate in between "RAM" and "ROM". (04 Marks)

(d) Draw diagrams for Raid levels 0 and 1. (05 Marks)

(e) State three (03) methods of memory allocation and explain them. You may use diagrams or examples for the explanation. (06 Marks)

Question 05 (20 Marks)

(a) Define the term "file directory". (02 Marks)

(b) What are the three types of buses in computers? (03 Marks)

(c) Differentiate in between "network attached storage (NAS)" and "storage area network (SAN)". You may use diagrams if needed. (04 Marks)

(d) Illustrate using a diagram how paging works with translation look-aside buffer (TLB). (05 Marks)

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(e) Compare the speed and capacity of "cache memory", "main memory" and "virtual memory". (06 Marks)

Question 06 (20 Marks)

(a) Define the terms "threat" and "attack". (02 Marks)

(b) State three (03) ways how computer viruses spread. (03 Marks)

(c) State four (04) security violation methods in a computer system. (04 Marks)

(d) Define the term "deadlock" and provide a simple example. (05 Marks)

(e) Write an explanation about readers-writers problem in synchronization (06 Marks)

Question 07 (20 Marks)

(a) What is called as a "cooperating process"? (02 Marks)

(b) Write a brief description about the OS level security method "firewall". (03 Marks)

(c) What are "digital signatures" and how useful they are in authentication processes in computer systems? (04 Marks)

(d) Explain how a secure communication can be done over an insecure medium. You may use diagrams if needed. (05 Marks)

(e) Explain how semaphores can be used as a synchronizing tool. (06 Marks)

Question 08 (20 Marks)

(a) What are the two types of CPU scheduling? (03 Marks)

(b) State all CPU scheduling criteria. (05 Marks)

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(c) Draw the Gantt chart for SJF scheduling (preemptive) and calculate the average waiting time. (04 Marks)

Process	Arrival time	Burst time
P0	0	5
P1	2	2
P2	3	4
P3	3	3

(d) Draw the Gantt chart for FCFS scheduling and for Round Robin (1ms Quantum). (08 Marks)

For the Round Robin consider that all processes arrive at the same time when clock says 0.

Then calculate the average waiting time and average turnaround time for both scheduling methods.

Process	Arrival time	Burst time
P1	0	3
P2	2	4
P3	1	5
P4	3	6

----------*END OF THE QUESTION PAPER*----------

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Year 2 Semester 1

SEMESTER END EXAMINATION

Probability and Statistics- GS2105

- There are EIGHT (08) questions in this paper.
- This paper contains five (05) pages.
- Excluding the Compulsory question-answer any four (04) questions.
- You may use appropriate graphs, diagrams, equation/s to prove or justify the answers.
- If you have any doubt as to the interpretation of the wording of a question, make your own decision, but clearly state it on the script.

Date: 2022.05.23 Time: 03 Hour

Question 01: (Compulsory) (20 Marks)

(a) State bayes theorem. (04 Marks)

(b) Explain Independent Events and dependent Events. (06Marks)

(c) Three urns contains 6 red, 4 black, 4 red, 6 black; 5 red, 5 black balls respectively. One of the urns is selected at random and a ball is drawn from it. If the ball drawn is red find the probability that it is drawn from the first urn. (10 Marks)

Question 02 (20 Marks)

(a) What are the differences between discrete and continuous random variables? (04 Marks)

(b) How do you know if a probability distribution is discrete? (04 Marks)

(c) What is binomial distribution and mention its formula? (04 Marks)

(d) The probability of passing an examination is 0.7. Out of 15 students, evaluate the probabilities that

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i. all 15 will pass
ii. none will pass
iii. at least 12 will pass

(08 Marks)

Question 03 (20 Marks)

(a) State poisson distribution (04 Marks)

(b) A car hire firm has two cars which it hires out day by day. The number of demands for a car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the number of days in a year on which

I. neither car is on demand ($e^{-1.5}= 0.2231$)
II. a car demand is refused. (10 Marks)

(c) Show that, $\sigma 2=E(X2)-\mu$
Where μ is the mean of X (06 Marks)

Question 04 (20 Marks)

(a) What is continuous distribution? (04 Marks)

(b) The diameter of an electric cable is assumed to be continuous random variate with probability density function: $f(x) =6x (1-x) ,0\leq x\leq 1$

I. Verify that above is a probability density function.
II. Find the mean and variance

(08 Marks)

(c) If the probability density function of a random variable x is

b. $f(x) = \begin{cases} \text{i. } Kx^{(\alpha-1)}(1-x)^{(\beta-1)}, \text{ for } 0< x <1 ,\alpha>0, \beta>0 \\ 0 \qquad\qquad , \text{otherwise} \end{cases}$

Find k and mean of x. (08 Marks)

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Question 05 (20 Marks)

(a) On a final examination in mathematics, the mean was 72, and the standard deviation was 15. Determine the standard scores of students receiving graders.

60 93 72

(06 Marks)

(b) Five thousand candidates appeared in a certain examination carrying a maximum of 100 marks. It was found that the marks were normally distributed with mean 39.5 and with standard deviation 12.5. Determine approximately the number of candidates who secured a first class for which a minimum of 60 marks is necessary. You may see the table given below (x denotes the deviation from the mean). The proportion A of the whole area of the normal curve lying to the left of the ordinate at the deviation x/σ

x/σ	1.5	1.6	1.7	1.8
A	0.93319	0.94520	0.95543	0.96407

(07 Marks)

(c) The mean inside diameter of a sample of 200 washers produced by a machine is 0.0502 cm and the standard deviation is 0.005 cm. The purpose for which these washers are intended allows a maximum tolerance in the diameter of 0.496 to 0.508cm, otherwise the washers are considered defective. Determine the percentage of defective washers produced by the machine, assuming the diameters are normally distributed.

(07 Marks)

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Question 06 (20 Marks)

(a) What is population mean vs sample mean? (04 Marks)

(b) The diameter of a component produced on a semi-automatic machine is known to be distributed normally with a mean of 10 mm and a standard deviation of 0.1 mm. If we pick up a random sample of size 5, what is the probability that the same mean will be between 9.95 and 10.05mm?

(08 Marks)

(c) A sample of size 25 is picked up at random from a population which is normally distributed with a mean 100 and a variance of 36. Calculate

I. $\Pr\{\bar{x} \leq 99\}$

II. $\Pr\{98 \leq \bar{x} \leq 100\}$

(08 Marks)

Question 07 (20 Marks)

(a) Ten individuals are chosen at random from a population and their heights are found to be in inches 63, 63, 64, 65, 66, 69, 69, 70, 70, 71. Discuss the suggestion that the Mean height of universe is 65. For 9 degree of freedom t at 5%level of significance = 2.262. (06 Marks)

(b) A set of five similar coins is tossed 320 times and the result is

No. of heads	0	1	2	3	4	5
Frequency	6	27	72	112	71	32

Test the hypothesis that the data follow a binomial distribution.(chi-square distribution)

(06 Marks)

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(c) The following table gives the number of aircraft accidents that occurs during various days of the week. Find whether the accidents are uniformly distributed over the week.

Days	Sun.	Mon	Tues	Wed	Thurs	Fri	Sat	total
No.of accidents	12	12	12	12	12	12	12	84

Given: The values of chi-square significant at 5, 6, 7, are respectively 11.07, 12.59,14.07 at the 5% level of significance.

(08 Marks)

Question 08 (20 Marks)

(a) The regression equations calculated from a given set of observations for two random variables are

X= -0.4y+6.4 and y= -0.6x+4.6

Calculate $\bar{x}$,$\bar{y}$ and r.

(06 Marks)

(b) The two r egression equations of the variables x and y are X=18.13-0.87y and y= 12.64-0.50x Find

(i)Mean of x' s;

(ii)Mean of y' s;

(iii)The correlation coefficient between x and y.

(07 Marks)

(c) The following data regarding the heights (y)and the weights (x)of 100 college students are given:

$\sum x = 15000$, $\sum x^2 = 2272500$

$\sum y = 6800$, $\sum y^2 = 46.3025$

$\sum xy = 1022250$

Find the correlation coefficient between height and weight and state the equation of regression of height on weight. (07 Marks)

----------END OF THE QUESTION PAPER----------

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Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

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Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414