

**Fourth Semester B. E. (Computer Science and Engineering)
Examination**

OBJECT ORIENTED PROGRAMMING

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions carry equal marks.
- (2) Assume suitable data wherever necessary.
- (3) **There is Internal Choice in Question 2, 3, 4,**
- (4) **Question 1, 5 and 6 are compulsory.**

1. (A) Explain following terms with respect to object oriented programming :

(i) Data abstraction.

(ii) Inheritance.

(iii) Polymorphism.

3

(B) Write a program to create a class vector. Data member is a single dimensional array of integer to store the elements in vector. Include methods insertvalue to store value in vector, method add to add 2 vector objects and display () to display all elements of vector. Create objects of class vector in main () and demonstrate use all methods.

5

(C) What is meant by access modifier ? Explain with an example.

2

2. (A) Solve any Two :—

(i) Consider a Class A. Class B extends Class A. Class C extends class A. Class D extends class B. All classes have default argument constructor which prints the name of class. If an object of class D is made what would be the output ?

1

(ii) Explain static keyword with an example.

2

(iii) Consider a class with non abstract method defined in it. Still can a class be declared as abstract ? Can we create object of abstract class.

1

- (iv) Consider Interface in1 and interface in2 with methods meth1() and meth2() respectively. Interface in2 inherits in1. Give only the declaration of interface in2. If class A inherits interface in2 which methods class B must have so that it does not becomes abstract. 1

- (B) Create a queue interface with methods as insert and delete. Create a class circular queue to implement queue interface with fixed queue length. Create a class queuedemo with main() to demonstrate dynamic method dispatch. 5

- (C) Create a class student with data members as name and roll. Create an interface test with methods void get Test1Marks(int) and void get Test2Marks(int). Create another interface Assignment with void get Assignment1Marks(int) and void get Assignment2Marks(int). Create a Class internal which is derived from class student and implements test and assignment, write proper display() to display test and internal marks along with total internal marks. Create object of class internal and use all methods. 5

Solve any two :—

3. (A) Create an Array List of class student. Write proper program to sort Array List on total marks of student. Display the sorted list using iterator. 5
- (B) What is a generic ? Explain with an example bounded generic and role of wildcard in it. 5
- (C) Write a program to create a class which stores a username and password as string. Password must contain an alphabet, a number, a special character and minimum length of password is 8. If any of the condition is not satisfied throw a user defined exception. Handle the exception and also display which condition was not satisfied when the exception was raised. Write appropriate main(). 5

Solve any two :—

4. (A) Write a program to read a file which contains student data as roll number, name and marks in 3 subjects using DataInputStream. Compute total marks for each student and write the student information in a different file. 5
- (B) Explain life cycle of a thread. What is meant by thread priority ? Explain with a proper example. 5
- (C) Write a program to read a file data.txt. Convert all lower case string to upper case and write it to another file data2.txt. 5

5. (A) Write a program to demonstrate tabbed pane. Create 3 tabs. 1st tab should contain 3 checkbox. 2nd tab should contain 3 radiobutton and at a time only one radio button can be selected. 3rd tab should contain a table with columns as name and telephone number. 7
- (B) Explain ActionListener with example. 3
6. (A) What is a servlet ? Explain init(), doGet() and doPost() methods with an example. 5
- (B) Consider an employee table in database which stores information about name and salary of an employee. Write a program to connect to database using JDBC. Insert 3 records in database. Update salary of those employees by 10% whose salary is greater than 20000 ? 5

Course Code : CST 207

NMPM/RS - 15/5362

**Fourth Semester B. E. (Computer Science and Engineering)
Examination**

OPERATING SYSTEMS

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions carry marks as indicated.
- (2) Due credit will be given to neatness and adequate dimensions.
- (3) Assume suitable data wherever necessary.
- (4) Diagrams and chemical equations should be given wherever necessary.
- (5) Illustrate your answers wherever necessary with the help of neat sketches.
- (6) Retain the construction Lines.
- (7) Mobile phones are prohibited in examination hall.

1. (a) Solve any One :—

- (i) Discuss the advantages of a multiprocessor system. Discuss clustered systems in detail. 5
- (ii) How hardware protection can be achieved ? Also discuss CPU and memory protection. 5

- (b) What is the purpose of system calls ? Using Linux system call write a C program that reads data from one file and copies it to another file. 5

2. (a) Discuss in detail how the information present in file can be accessed in different ways. 5

(b) Solve any one :

- (i) What is dynamic storage allocation ? How free space management is implemented ? 5
- (ii) Suppose that a disk drive has 2000 cylinders, numbered 0 to 1999. The drive is currently serving 134 and previous request was 109. The queue of pending requests order is, 54, 765, 234, 456, 12, 900, 342, 5

NMPM/RS-15/5362

Contd.

(iii) Starting from current head position, what is the total number of head movements needed for the disk arm to satisfy the pending requests for each of the following disk scheduling algorithms ?

- (a) FCFS
- (b) SSTF
- (c) SCAN
- (d) LOOK
- (e) C-SCAN

5

3. (a) Solve any one :

(i) What is the responsibility of a scheduler ? Discuss different types of schedulers. 5

(ii) Five processes arrive at following time, in the given order :

| Process | Burst Time | Arrival Time | Priority |
|---------|------------|--------------|----------|
| P1 | 06 | 0 | 1 |
| P2 | 10 | 2 | 3 |
| P3 | 03 | 3 | 2 |
| P4 | 07 | 4 | 4 |
| P5 | 05 | 5 | 5 |

Draw the Gantt chart and find average waiting time using SRTF and priority algorithm. 5

(b) Differentiate between single threaded and multithreaded process.

Discuss the multithreading models. 5

4. (a) Solve any one :

(i) Draw the neat diagram for a paging hardware and explain the mechanism of paging. 5

(ii) What is the cause of trashing ? Explain the working set model. 5

- (b) Given memory partitions of 100 KB, 500 KB, 200 KB, 300 KB and 670 KB (in order), how would each of the first fit, best fit and worst fit algorithms place processes of 245 KB, 512 KB, 398 KB and 119 KB (in order) ? Find the total internal fragmentation in each case. Which algorithm makes the most efficient use of memory ? 5
5. (a) Elaborate dining philosopher's problem and also explain the monitor base solution to it. 2
- (b) Solve any one :
- (i) Discuss any two approaches in Two process solutions to a critical section problem. 5
- (ii) What is busy waiting ? Why spinlocks are not appropriate for uniprocessor system but may be used for multiprocessor systems ? 5
6. (a) What are the ways in which deadlock can be prevented ? 5
- (b) Explain bankers algorithm with an example. 5

Course Code : CST 208

NMPM/RS-15/5363

**Fourth Semester B. E. (Computer Science and Engineering)
Examination**

THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions carry equal marks.
- (2) Due credit will be given to neatness and adequate dimensions.
- (3) Assume suitable data wherever necessary.
- (4) Illustrate your answers wherever necessary with the help of neat sketches.
- (5) Mobile phones are prohibited in examination hall.

1. (a) Prove using principle of mathematical induction, $n^4 - 4n^2$ is divisible by 3 for $n \geq 0$. 4
(b) Explain pigeon hole principle. Also state its applications. 2
(c) What is a relation ? Consider relation R on a set $A = \{1, 2, 3, 4\}$ defined below and prove that given relation is an equivalence relation.
 $R = \{(1, 1), (1, 2), (2, 2), (2, 1), (3, 3), (4, 4)\}$. 4

OR

2. (a) Construct language generated from the following given grammar.
 1. $S \rightarrow aCa$
 $C \rightarrow aCa \mid b$
 2. $S \rightarrow AB$
 $A \rightarrow aAb \mid ab$
 $B \rightarrow cBd \mid cd$3

NMPM/RS-15/5363

Contd.

(b) Identify the type of following Grammar

1. $S \rightarrow ACaB$
 $Ca \rightarrow aaC$
 $CB \rightarrow DB$
 $aD \rightarrow Da$
 $aE \rightarrow Ea$
 $AE \rightarrow \epsilon$
2. $S \rightarrow gA$
 $S \rightarrow SBC$
 $S \rightarrow BC$
3. $S \rightarrow SBC$
 $S \rightarrow aC$
 $B \rightarrow a$
 $CB \rightarrow BC$
 $Ba \rightarrow aa$
 $C \rightarrow b$
4. $S \rightarrow BC$
 $B \rightarrow C \mid a$
 $C \rightarrow t$
 $A \rightarrow aA \mid gB \mid g$
 $B \rightarrow gA$
 $B \rightarrow a$
 $C \rightarrow t$

2

5

(c) Explain Chomsky hierarchy classification of languages.

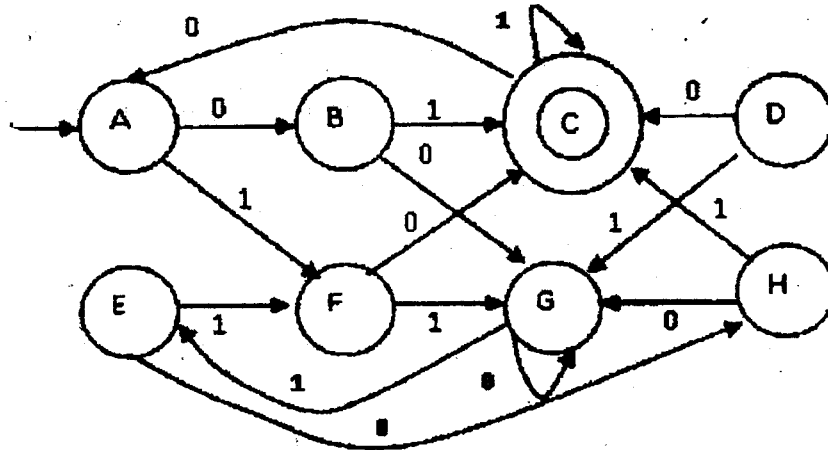
3. (a) Design DFA for the following language over $\{0, 1\}$

(i) The language which accepts strings, in which every 00 is followed immediately by 1.

(ii) The language which accepts the strings, in which the third symbol from the rightmost end is 0.

4

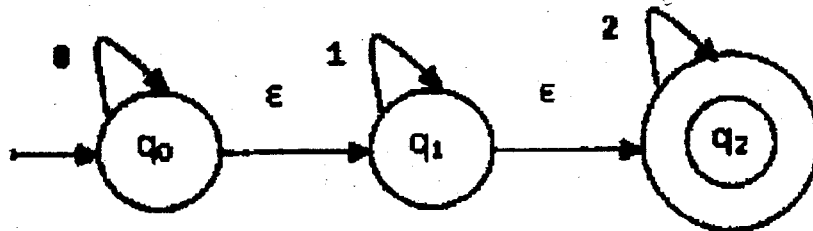
- (b) Obtain minimum state DFA for the given automata



6

OR

4. (a) Convert given NFA with ϵ transitions to NFA without ϵ transition and hence convert it to DFA.



6

- (b) Convert given Mealy Machine to its equivalent Moore Machine.

| Current State | I / P = a | | I / P = b | |
|---------------|-----------|--------|-----------|--------|
| | State | Output | State | Output |
| A | B | 1 | C | 1 |
| B | C | 0 | A | 1 |
| C | A | 1 | B | 0 |

4

5. (a) Prove that given language $L = \{ a^p \mid p \text{ is a prime number} \}$ is not regular. 3

(b) Convert given Right Linear grammar to Left Linear Grammar (Optimized Grammar).

$$S \rightarrow 01B \mid 0$$

$$B \rightarrow 1B \mid 11$$

4

(c) Construct CFG which generates

(1) strings of balanced parenthesis

(2) palindromes for binary numbers. 3

OR

6. (a) Consider given grammar

$$S \rightarrow aB \mid bA$$

$$A \rightarrow a \mid aS \mid bAA$$

$$B \rightarrow b \mid bS \mid aBB$$

Generate Leftmost Derivation, Rightmost Derivation and Derivation tree for the string $w = aaabbabbba$. 4

(b) Convert given CFG to Greibach Normal Form (GNF)

$$S \rightarrow AA \mid 0$$

$$A \rightarrow SS \mid 1$$

3

(c) Reduce the given grammar

$$S \rightarrow ABAC$$

$$A \rightarrow aA \mid \epsilon$$

$$B \rightarrow bB \mid \epsilon$$

$$C \rightarrow c$$

3

7. (a) Design Push Down Automata for the language
 $L = \{ a^n b^m \mid m, n > 0 \text{ and } m = 2n \}$ 5

- (b) Consider the following PDA and construct equivalent CFG.

$$M = (\{q_0, q_1\}, \{0, 1\}, \{X, Z_0\}, \delta, q_0, Z_0, \Phi)$$

$$\delta(q_0, 1, z_0) = \{(q_0, XZ_0)\}$$

$$\delta(q_0, 1, X) = \{(q_0, XX)\}$$

$$\delta(q_0, 0, X) = \{(q_1, X)\}$$

$$\delta(q_0, \epsilon, Z_0) = \{(q_0, \epsilon)\}$$

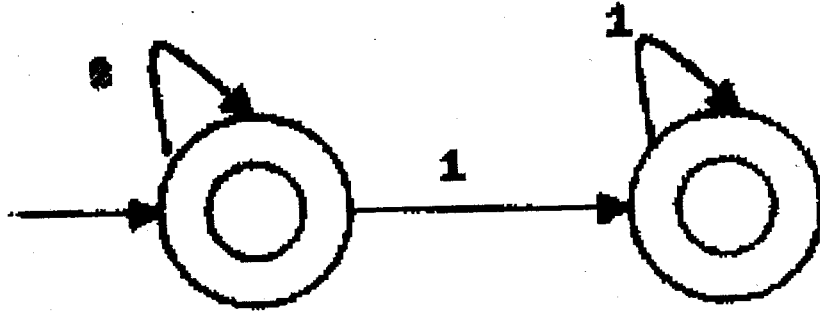
$$\delta(q_1, 1, X) = \{(q_1, \epsilon)\}$$

$$\delta(q_1, 1, Z_0) = \{(q_0, Z_0)\}$$

5

OR

8. (a) Consider given DFA,



Construct Regular expression for it and design PDA.

4

- (b) Construct PDA for the given language $L = \{a^m b^n c^{m+n} | n \geq 1\}$.

6

9. Design Turing Machine for the language $L = \{a^n b^n c^n | n \geq 1\}$. Show string acceptance for the string $w = aaabbbccc$.

10

OR

10. (a) Design Turing Machine for concatenation of two strings.

5

- (b) Design TM for 2's Complement of a binary number.

5

11. (a) What is Post Correspondence Problem ? Find solution for the following instance of PCP.

| i | List X | List Y |
|---|--------|---------|
| 1 | abab | ababaaa |
| 2 | aaabbb | bb |
| 3 | aab | baab |
| 4 | ba | baa |
| 5 | ab | ba |
| 6 | aa | a |

- (b) Give relationship between Recursive and Recursively Enumerable language. 5
- (c) Show that multiplication function of two positive integers is primitive recursive. 2

OR

12. (a) Define Ackermann's Function. Using Ackermann's Function, compute $A(1, 1)$, $A(2, 1)$ and $A(2, 2)$. 6

- (b) Explain any two :—

- (1) Halting Problem of Turing Machine
- (2) Universal TM
- (3) Multi-tape TM.

4

Course Code : HUT 201

NMPM/RS-15/5381/5382

**Fourth Semester B. E. (Computer Science and Engineering /
Information and Technology) Examination**

TECHNICAL COMMUNICATION

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) Due credit will be given to neatness and adequate dimensions.
- (2) Assume suitable data wherever necessary.
- (3) Illustrate your answers wherever necessary with the help of neat sketches.
- (4) Mobile phones are prohibited in examination hall.

1. How does one achieve conciseness in technical communication ? 10
2. List out the essential and optional components of a letter. 10
3. Explain the ways to achieve effective document design. 10
4. (A) Explain the criteria for writing an abstract for a conference. 5
 - (B) (a) Format the following references as per APA style :
 - Conttrel R C 1992 Izzy : a biography of I. F. Stone. New Brunswick, NJ Rutgers University Press.
 - Gerson S M and Eddings E 1996 fall Service learnings : Internships ... with a conscience. Missouri English Bulletin 54 70 - 50. 2
 - (b) How will the following authors get cited in the text as per APA format ? :
 - Nadell J., McNeiman, L., and Langan, J. (1997) The rise and fall of man 1
 - (C) Give five important components of an article / research paper for a journal. 5

NMPM/RS-15/5381/5382

Contd.

5. What are the types of formal oral presentations ? What are the aspects that need to be kept in mind for making powerpoint presentations ?

10

6. (1) Write in each blank the letter of the word that best completes each sentence :
- (a) Will having a degree _____ (A. affect, B. effect) my chances for promotion ?
 - (b) I don't want to discuss my _____ (A. personal, B. personnel) problems in front of anyone.
 - (c) Use your best _____ (A. judgment, B. judgement) in selecting a service provider.

3

- (2) Write the letter of the word or phrase that best completes each sentence :
- (a) (A. Russ's, B. Russ') laptop was stolen last week.
 - (b) Speaking only for (A. me, B. myself), I think the new policy is discriminatory.
 - (c) India has increased (A. it's, B. its) imports of corn and rice.
 - (d) Anyone who wants to be (A. their, B. his or her) own boss should think about owning a franchise.

4

Course Code : MAT 245

NMPM/RS-15/5394/5395

**Fourth Semester B. E. (Computer Science and Engineering
Information and Technology) Examination**

DISCRETE MATHEMATICS

Time : 3 Hours]

[Max. Marks : 60

Instructions to Candidates :—

- (1) All questions carry equal marks.
- (2) Use of programmable calculator is permitted.

1. Solve any two :

(a) For any two sets A and B prove the following :—

- (i) $(A-B) \cap B = \phi$
- (ii) If $(A \cup B) = \phi$ then prove that $A = \phi$, $B = \phi$.
- (iii) $A - B \subset B^c$

(b) Consider the functions $f, g: \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = x^2 + 3x + 1$, $g(x) = 2x - 3$.

Find the composition functions $f \circ f$, $f \circ g$ and $g \circ f$.

(c) Define equivalence relation and equivalence classes.

Let R be the equivalence relation on the set $A = \{p, q, r, s, t\}$ defined by partition $P = \{\{p, s\}, \{q, r\}, \{t\}\}$. Determine the elements of R and also find the equivalence classes of R. 10

2. Solve any two :-

(a) Determine the validity of the following argument using truth table as well as without truth table :

"If the market is free then there is no inflation. If there is no inflation then there are price controls. Since there are price controls, therefore the market is free."

NMPM/RS-15/5394/5395

Contd.

(b) Find the PDNF of $p \rightarrow ((p \rightarrow q) \wedge \neg(\neg q \vee \neg p))$ without constructing truth table.

(c) Write the converse, inverse, negation and contrapositive of

"I will go to the store if I had time and I am not too tired." 10

3. Solve any two :-

(a) Define Subgroup of a Group.

Let G be a group of integers under the operation of addition. Which of the following subsets of G is a subgroup of G ?

(i) the set of all even integers.

(ii) the set of all odd integers. Justify your answer.

(b) Let G be a group. Show that the function $f : G \rightarrow G$ defined by $f(a) = a^{-1}$ is an isomorphism if and only if G is commutative group.

(c) Prove that, a subgroup N of a group G is a normal subgroup of G if and only if the product of two right cosets of N in G is again the right coset in G . 10

4. Solve any two :-

(a) (i) Suppose J and K are ideals in a ring R , prove that $J \cap K$ is an ideal in R .

(ii) Let J be an ideal in a ring R with an identity element 1 , prove that if $1 \in J$ then $J = R$.

(b) Define ring homomorphism. If $f : R \rightarrow R^*$ is a ring homomorphism then prove that

(i) $f(0) = 0^*$, where 0^* is zero element of R^*

(ii) $f(-a) = -f(a)$, $\forall a \in R$.

(c) Show that the set $\{0, 1, 2, 3, 4, 5, 6\}$ is a commutative ring with respect to addition modulo 7 and multiplication modulo 7 as composition. 10

5. (a) Construct the switching circuit of the following Boolean expression.

$$(A+B) (A' + C) + B(B' + C).$$

Simplify this Boolean expression and construct an equivalent switching circuit.

5

- (b) Show that in a Lattice if $a \leq b \leq c$ then

(i) $a \oplus b = b * c$

(ii) $(a*b) \oplus (b*c) = b = (a \oplus b) * (b \oplus c)$ where $*$ is meet and \oplus is join operations.

5

6. (a) Find the closed form of generating function for each of the following sequence :

(i) 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0,....

(ii) 0, 0, 1, 2, 3, 4,....

4

- (b) Find the minimum number of students in a class to be sure that five out of them are born in the same month.

3

- (c) Let n be a positive integer, then prove the following Binomial identity.

$$\binom{n}{0} + \binom{n}{2} + \binom{n}{4} + \dots = \binom{n}{1} + \binom{n}{3} + \binom{n}{5} + \dots$$

3

