

Course Code : CST 206

MARR/RS-13/4622

S-13

**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) Due credit will be given to neatness and adequate dimensions.
- (3) Illustrate your answer wherever necessary with the help of neat sketches.

1. (a) Object oriented paradigm is more data centric as compared to structured programming paradigm—Explain. 4
- (b) Explain with a programming example. What is the difference between abstraction and encapsulation ? 4
- (c) Give different types of inheritance. 2

OR

2. (a) What is polymorphism ? Comment on static polymorphism. 4
 - (b) Late binding can slow down the program execution. Explain if it is true. 3
 - (c) Inheritance is used to increase the reusability of the code. Comment. 3
-
3. (a) Differentiate between a class and an object. Give an example. 3
 - (b) What are constructors ? Give different types of constructor with an example of each. 4
 - (c) What is a deep copy and shallow copy in copy constructor ? Explain with an example. 3

MARR/RS-13/4622

Contd.

OR

4. (a) What are members of a class ? How can these members be accessed from different classes ? 3
- (b) Write a JAVA code to overload an operator '+' to operate on different data types viz. numbers and strings. The result should be
Number 1 + number 2 = addition of two nos.
String 1 + string 2 = concatenation of two strings. 5
- (c) Give an example and explain what are non-static members of a class. 2
5. (a) Write a JAVA code to create class person. Derive the classes Teacher and student from person and instantiate at least one object of Teacher and student. Explain the code with appropriate comments. Use appropriate data members and methods. 4
- (b) What are friend functions ? In what situations friend functions will be used in practice ? 3
- (c) With an example, show different ways of creating a derived class. 3

OR

6. (a) Write a pseudo code to create a class shape. Create subclasses, circle and triangle to a superclass shape. Write area () method in all the three. Based on the pointers, how overriding is done for the area method, demonstrate. 6
- (b) Explain the concept of run time polymorphism with an appropriate example. What are different situations in real time programming which can be handled using this concept ? 4
7. (a) What is base class of error and exception ? Differentiate between throw and throws with proper code. 5
- (b) Explain with the JAVA code how multiple inheritance can be implemented. Use proper interface. 5

OR

8. (a) Why are exceptions needed to be handled in a program ? Write a JAVA code to implement a function which accepts a route-id of a flight reservation system and displays various flights available on that route with total fare. Use appropriate information stored in a database. If the route-id is not present, throw user defined exception and write an appropriate exception handler (* Assume database and don't create it). 5
- (b) Define abstract class. How is it different from interface ? Is it necessary to implement each method of a base class into the derived class ? If yes, explain, if not, state the reasons. 5
9. (a) Write a JAVA code to implement circular queue. Demonstrate all boundary conditions. 5
- (b) Write a JAVA ode to toggle the contents of a text file ABC. Txt : (If a file contains "I am an Indian". Convert it to " I am aN iNdIaN). 5

OR

10. (a) Why should we use templates ? With an example, demonstrate the use of templates. 3
- (b) State the use of serialization and deserialization of objects considering the example of JVMs (JAVA Virtual Machines). 4
- (c) Write down a java code to generate a linear singly linked list having at least four nodes. 3
11. (a) What are design patterns ? State and explain briefly the type of patterns which any Library application block uses. 5
- (b) What is refactoring ? Identify the real time applications where refactoring can be used as tool. 5

OR

12. (a) How many types of UML diagrams are there ? Explain any two diagrams with an example of each. 5
- (b) Explain how singleton design pattern can be used in JAVA with example. Also comment on how this is useful. 5

**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) Assume suitable data wherever necessary.
- (3) Illustrate your answers wherever necessary with the help of neat sketches and examples

1. (a) What is distributed operating system ? Explain the characteristics of distributed O. S. 6
- (b) Explain time sharing systems. 4

OR

2. (a) What are the different services provided by modern operating system ? 6
- (b) Is a single ready queue on a multi processor a good idea ? Why ? 4

3. (a) Explain various file access methods in detail. 6
- (b) Explain in brief the following terminologies related to disk arm scheduling
(1) SCAN
(2) LOOK 4

OR

4. (a) In some systems, a subdirectory can be read and written by an authorized user, just as ordinary files can be :—

- (a) Describe the protection problems that could arise.
- (b) Suggest a scheme for dealing with each of these protection problems.

5

- (b) A disk is having 32 surfaces, 1 K tracks in 1 surface, 512 sectors in 1 track, 4096 B in 1 sector, avg seek time = 30 ms. Disk RPM = 3600 calculate :—

- (1) Capacity of the disk (In bytes)

- (2) Effective data transfer rate (in Bytes/sec).

5

5. (a) Explain the difference between :—

- (1) Kernel level thread and user level thread.

- (2) Short term scheduler and long term scheduler.

4

- (b) Given the set of processes, with the length of the CPU burst time (in milliseconds)

Process	Busrt Time	Priority	Arival Time
P ₁	10	3	1
P ₂	6	5	2
P ₃	2	2	3
P ₄	4	1	4
P ₅	8	4	5

- (1) Draw Gantt chart

- (2) Calculate average waiting time and average turnaround time for each of following algorithms

- (1) FCFS

- (2) Preemptive SIF

- (3) Preemptive priority (5 being the highest priority)

6

OR

6. (a) What is PCB ? What specific information about process is represented in PCB ?

6

- (b) What are the goals of CPU scheduling ? 4
7. (a) Given the memory partitions of 100 Kb, 500 KB 200 KB, 300 KB and 600 KB (in order) how would the first fit, best fit and worst fit algorithms place processes of 212 KB 417 KB, 112 KB and 426 KB (in order)? Which algorithm makes the most efficient use of memory ? 4
- (b) What is shared Memory ? Write a psuedo code explaining usage of shared Memory. 6
8. (a) Given the page reference string
1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 2, 3, 6
How many page faults would occur for the following replacement algorithm.
Assume five and seven frames.
- (1) LRU
- (2) FIFO
- (3) Optimal 6
- (b) Write a short note on demand paging. 4
9. (a) A barber shop consists of a waiting room withn chairs and a barber room with one barber chair. If there are no customers to be served, the barber goes to sleep. If a customer enters the barber shop and all the chairs are occupied then the customer leaves the shop. If the barber is busy but chairs are available, then the customer sits in one of the free chairs. If the barber is asleep, the customer wakes up the barber. Write a program to coordinate the barber and the customer. 6
- (b) Differentiate between Binary semaphore and Counting Semaphore. 4
- OR**
10. (a) What do you mean by bounded waiting ? How can it be achieved? 4
- (b) Give a monitor solution to the dining philosopher problem. 6

11. (a) Assume a maximum claim reusable resource system with four processes and three resources types. The total units of each resource type are given by vector (5, 8, 16). The claim matrix C and the allocation matrix A are given below.

$$C = \begin{bmatrix} 4 & 1 & 4 \\ 3 & 1 & 4 \\ 5 & 7 & 13 \\ 1 & 1 & 6 \end{bmatrix} \quad A = \begin{bmatrix} 0 & 1 & 4 \\ 2 & 0 & 1 \\ 1 & 2 & 1 \\ 1 & 0 & 3 \end{bmatrix}$$

- (1) Determine if the current state of the system is safe
 - (2) Determine if a request by process 1 for 1 unit of resource 1 can be safely granted.
 - (3) Determine if a request by process 3 for 6 units of resources can be safely granted. 6
- (b) Does deadlock prevention and deadlock avoidance result into less resource utilization than deadlock detection approach ? Why ? 4

OR

12. (a) Construct a general resource graph for the following scenario and determine if the graph is completely reducible R_1 , R_2 and R_3 are reusable resources with a total of two, two and three units respectively. Process P_1 is allocated one unit each of R_2 and R_3 and is requesting one unit of R_1 process P_2 is allocated one unit of R_1 and is requesting two units of R_3 . Process P_3 is allocated one unit each of R_1 and R_2 and is requesting one unit of R_3 5
- (b) Consider a system consisting of m resources of the same type being shared by n processes. A process can request or release only one resource at a time. Show that the system is deadlock free if the following two conditions hold.
- (a) The maximum need of each process is between one resource and m resources.
 - (b) The sum of all maximum needs is less than $m + n$. 5

Course Code : CST 208

MARR/RS-13/4624

**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 marks as indicated.
- (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.

1. (a) Define Language, Relation. 2
- (b) State pigeon-hole principle. Also specify its applications. 2
- (c) Design regular grammar for following languages $\Sigma = \{a, b\}$
 - (i) $L = \{a^n b^m : n \geq 2, m \geq 3\}$
 - (ii) $L = \{a^n b^m : n + m \text{ is even}\}$
 - (iii) $L = \{w : n_a(w) \text{ and } n_b(w) \text{ is odd}\}$ 3
- (d) Consider a grammar.
 $S \rightarrow a / \Lambda / (T)$
 $T \rightarrow T, S / S$
Check validity of strings.
 - (i) $((a, a), a)$
 - (ii) $((((a, a), \Lambda, ((a)), a).$ 1 + 2

OR

2. (a) What do you understand by countability of a set ? Also discuss countability of set containing all real numbers. 3

MARR/RS-13/4624

Contd.

(b) Design content free grammars for following languages :

(i) $L = \{ww^R : w \in \{a, b\}^*\}$

(ii) $L = \{a^n b^m c^k : k = n + m\}$

(iii) $L = \{a^n b^n : n \geq 0\}$

3

(c) State whether the following statements are true or false with justification :—

(i) NFA is powerful than DFA.

(ii) Regular languages are closed under reversal.

(iii) Intersection of two content free languages is also content free.

(iv) Checking ambiguity of CFG is undecidable.

4

3. (a) Design DFA for the following languages on $\Sigma = \{a, b\}$.

(i) All strings with no more than 3 a's.

(ii) $L = \{w \mid n_a(w) \bmod 3 > n_b(w) \bmod 3\}$.

(iii) $L = \{w \mid \text{every run of a's has length either two or three}\}$.

6

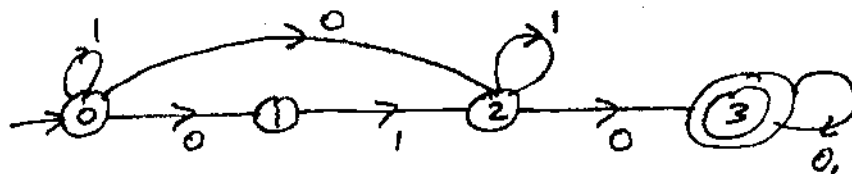
(b) Minimize following finite automata :

δ	a	b
$\rightarrow A$	B	E
B	C	F
C	C	F
* D	C	D
E	E	E
F	C	D

4

OR

4. (a) Obtain DFA equivalent of following NFA :



5

- (b) Design a Moore machine to read any binary number and display values of remainder if divided by 3. Also convert this machine into its equivalent Mealy machine.

5

5. (a) Prove or disprove : $(a + b)^* = a^* + b^*$.

2

- (b) Using Pumping Lemma prove $L = \{a^n b^m c^{m+n} / m, n \geq 1\}$ is not regular.

3

- (c) Comment on ambiguity of following grammar :

$$S \rightarrow iCtSeS / iCtS / a$$

$$C \rightarrow c$$

2

- (d) Reduce following CFG :

$$S \rightarrow aC / SB$$

$$A \rightarrow bSCa / \epsilon$$

$$B \rightarrow aSB / bBC / b$$

$$C \rightarrow D$$

$$D \rightarrow E$$

$$E \rightarrow aBC / ad / \epsilon$$

3

OR

6. (a) Obtain right linear regular grammar for

$$RE = (1 + 00^* 1) + (1 + 00^* 1) (0 + 10^* 1)^* (0 + 10^* 1)$$

6

- (b) Convert following grammar into CNF and GNF form.

$$S \rightarrow AACB$$

$$A \rightarrow Ba / Ab$$

$$B \rightarrow bb$$

$$C \rightarrow d$$

4

7. (a) Construct PDA for language

$$L = \{0^m 1^{m+n} 0^n / m, n \geq 1\}$$

6

- (b) Describe method to convert PDA with final state to PDA with empty stack. 4

OR

8. Construct CFG after getting PDA for the language :

$$L = \{a^n b^m c^n / m, n \geq 1\}$$

10

9. (a) Design a Turing machine to accept the string of 0^s and 1^s having equal no. of 0^s and 1^s . 5
(b) Describe different variations of Turing machine. 5

OR

10. (a) Design a TM to calculate proper subtraction of unary numbers. 7
(b) Prove that TM is equivalent to computes. 3

11. (a) Show that the following functions are primitive recursive.

$$(i) \quad f(m, n) = \begin{cases} m & \text{if } m \geq n \\ n & \text{otherwise} \end{cases}$$

$$(ii) \quad f(x, y) = |x - y|$$

$$(iii) \quad f(x, y) = x^{2y}$$

6

- (b) Define recursive and recursive enumerable languages and specify relationship between them. 4

OR

12. (a) What is μ -recursive function ? 2
(b) What is Ackermann function ? Prove following :—

$$(i) \quad A(1, y) = y + 2$$

$$(ii) \quad A(2, y) = 2y + 3$$

4

- (c) Prove that " $L(m)$ contains ϵ for any Turing machine on" is undecidable. 4

Course Code : HUT 201

MARR/RS-13/4625/4652

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

TECHNICAL COMMUNICATION

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.

1. Define technical writing and state its importance. Explain the writing process ? 10

OR

2. What are the objectives of technical writing ? Explain with examples the significance of these objectives when writing at work ? 10

3. Draft a memo using mind mapping technique for the given situation.

- (a) A major project is being introduced at work. Attempt a memo informing your work team of their individual responsibilities and schedules. 10

OR

4. Write a project completion report for the assignment you just completed for technical communication. 10

5. What are the different strategies used to achieve effective document design ? Substantiate the answer with appropriate examples. 10

OR

6. Write short notes in not less than 250 words for the following :—

- (a) Characteristics of effective tables and figures.
- (b) Colors and their importance and three dimensional graphics. 10

MARR/RS-13/-4625/4652

Contd.

7. What are the several criteria which constitute a well constructed summary ? 10

OR

8. What is the criteria of writing a proposal ? 10

9. Write short notes on :—

(a) Tips for using power point.

10

(b) Parts of a formal presentation.

OR

10. What is the purpose of Group Discussion ? What are the personality traits tested in a group discussion ? 10

11. The following sentences contain errors in spelling, punctuation, verbs and pronoun agreement, sentence structure and modifications. Identify the errors and rewrite the correct sentences as answers :—

(a) By eliminating unnecessary wording, this would decrease cost by \$ 10.00 per book.

(b) While cost savings initiatives and quality have become critical for businesses to remain competitive today.

(c) The jointer has three important parts the infeed table the cutturhead and the outfeed table

(d) According to Jones 1999 the average customers is a tourist who travels in the summer and tends to purchase collectibles and small antiques.

(e) Biology is not the only field of science that nanotechnology will permeate this revolution can quite possibly influence all sciences and most likely create more. 10

OR

12 Do as directed :—

(a) Two methods currently exist to enhance fiber performance, one method is to orient the fibers. (Correct the comma splices)

(b) Offset is also known as offset lithography as litho printing the offset process uses a flat metal plate with a smooth printing surface that is not raised or engraved.

(Identify and eliminate the run-on and write the correct sentence.

- (c) The total cost is \$ 425, on which will have to come from the contingency fund.
(Identify and eliminate sentence fragments)
- (d) When filling out an on-line document, personal data always appears first.
(Rewrite the sentence correctly)
- (e) As more and more nodes are installed it affects the time it takes for information to travel around the ring.
(Make the pronoun references clear)

10

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 calculator is permitted.

1. (a) Let $x = \{1, 2, 3, \dots, 10\}$. Define xRy to mean that 3 divides $x-y$.
 - (i) Show that R is an equivalence relation.
 - (ii) How many equivalence classes are there ?
 - (iii) Write partition of a set X . 5

- (b) Define power set of a set X

If $n(X) = n$ show that $n(p(X)) = 2^n$

If $x = \{a, b, \{a, b\}\}$ find power set of X . 5

OR

2. (a) Define compatibility relation on a set X .

Let $X = \{\text{ball, bed, dog, egg, let}\}$

$R = \{(x, y) \mid x, y \in X \text{ and } xRy \text{ if } x \text{ and } y \text{ contain some common letter.}\}$

Show that R is compatibility relation. 5

Find maximum compatibility blocks.

- (b) Given $g = \{(1, b), (2, c), (3, a)\}$ a function from $x = \{1, 2, 3\}$ to $Y = \{a, b, c, d\}$ and $f = \{(a, x), (b, x), (c, z), (d, w)\}$ a function from Y to $Z = \{w, x, y, z\}$.

(i) Write $f \circ g$ as a set of ordered pairs.

(ii) Write $(f \circ g)^{-1}$ and Is $(f \circ g)^{-1} = g^{-1} \circ f^{-1}$? 5

3. (a) For what truth values will the following statement be true ?
It is not the case that houses are cold or haunted and it is false that cottages are warm or houses ugly. 2

- (b) Show that truth values of the following formula is independent of their components.

$$(P \wedge (p \rightarrow q)) \rightarrow q \quad 3$$

- (c) Obtain the pdnf and pcnf of the following formula,

$$p \rightarrow (p \wedge (q \rightarrow p)). \quad 5$$

OR

4. (a) Symbolize :
If two persons fight over a third one's property, then the third one gains. 3

- (b) Test the validity of the following arguments.

If there was a ball game then traveling was difficult.

If they arrived on time, then travelling was not difficult.

They arrived on time

Therefore there was no ball game. 5

- (c) Given the truth values of p and q as T and the truth values of r and S as F. Find the truth values of

$$(\sim (P \wedge q) \vee \sim r) \vee ((\sim P \wedge q) \vee \sim r) \wedge s \quad 2$$

5. (a) Define order of an element of a group.

If x and y are two elements of any group G

prove that xy and yx have the same order. 5

- (b) Let Z be the set of integers Show that the operation * on Z defined by

$$a * b = a + b + 1, \text{ for all } a, b \in Z$$

Satisfies the closure property, associative Law and the communicative law.

Find the identity element, if exist.

What is the inverse of an integer a ? 5

OR

6. (a) Prove that the multiplicative group G consisting of the fourth root of unity is isomorphic to the group G' of residue classes modulo 4 under addition of residue classes. 5

- (b) Define index of a subgroup in a group;

Find the left cosets of $H = \{[0], [3]\}$ in the group $G = (Z_6, +_6)$. Find the index of H in G . 5

7. (a) A ring with identity is called a Boolean ring if $x^2 = x$ for all $x \in R$

(i) Show that Boolean Ring is Commutative.

(ii) In such ring show that $x + x = 0$ for all $x \in R$. 5

- (b) Let R, S be rings. A function $f: R \rightarrow S$ is called ring homomorphism if for all $x, y \in R$,

$$f(x + y) = f(x) + f(y) \text{ and } f(xy) = f(x)f(y)$$

The Kernel of F is defined as the set $\{x \in R \mid f(x) = 0\}$

Prove that the Kernel of a ring homomorphism is an ideal. 5

OR

8. (a) Prove that every field is an integral domain.

Is the converse true ?

Justify your answer with suitable example. 5

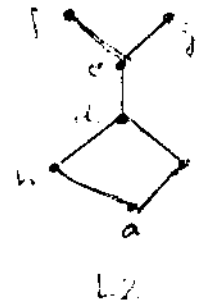
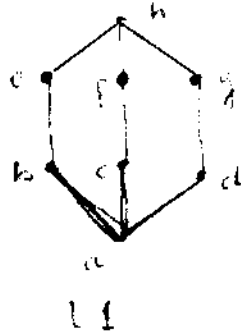
- (b) Define Galois field

A field F is said to be of characteristics 2 if $2a = 0$ for all $a \in F$

Show that $F = (Z_3 +_3, \times_3)$ is a Galois field of characteristic not 2. 5

9. (a) Define Lattice

Determine whether the posets by each of the Hasse diagram are lattices.



5

- (b) Let $(B, +, \cdot, ')$ be a Boolean Algebra.

Show that the following properties hold for all elements x, y of B .

(i) $x + x = x$ and $x \cdot x = x$

(ii) $x + 1 = 1$ and $x \cdot 0 = 0$

5

OR

10. (a) Let (L, \leq) be a lattice.

Show that for every $a, b \in L$

(i) $a \vee b = b$ iff $a \leq b$

(ii) $a \wedge b = a$ iff $a \leq b$

5

- (b) Draw the simplified switching circuit for the Boolean Expression.

$$(p + q) \cdot (p + t) + t \cdot (p + q \cdot t)$$

5

11. (a) State generated Pigeonhole Principle.

2

- (b) If we select any group of 1000 student on campus, show that at least three of them must have the same birthday.

3

- (c) Use generating function to solve the recurrence relation.

$$a_n = a_{n-1} + a_{n-2} \text{ with } a_0 = 0, a_1 = 1 \quad n \geq 2$$

5

OR

12. (a) Using Generating function show that for every positive integer n

$$\sum_{r=0}^n \binom{n}{r}^2 = \binom{2n}{n}$$

5

- (b) Let b be an integer greater than or equal to 2. If $b+1$ distinct integers are randomly selected prove that the difference of two of them must be divisible by b .

5

