

II
Sem - II-2023

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CBCS Scheme

Mid-Semester Examination Autumn 2023

MCA (3rd Semester)

Subject Name : Object Oriented Concepts & Java

Subject Code : CA403101CA

Time: Two Hours

Max Marks: 30

Note: All Questions are Compulsory.

UNIT-1

1. a. Write the difference between Java and CPP [2.5 M]
- b. Explain class and object with example. [2.5 M]
- c. Explain OOPS with its features? [5 M]
- d. Explain polymorphism and WAP to demonstrate implementation of static polymorphism. [5 M]

UNIT-2

2. a. Write the difference between interface and abstract class? [2.5 M]
- b. How do you implement garbage collection in Java? [2.5 M]
- c. Explain the architecture of JVM with diagram? [5 M]
- d. Explain inheritance and WAP to demonstrate multilevel inheritance. [5 M]

***** End *****

A4 Note Book

CS Scheme

Mid-Semester Examination Autumn 2023

MCA (3rd Semester)

Subject Name: Data Science

Subject Code: CA403102CA

Time: Two Hours

Max Marks: 30

- Note: (1) All the Questions are compulsory.
 (2) Draw neat and clean diagrams wherever required
 (3) Assume suitable data wherever required.

UNIT-1

- (a) Write a Python program to generate an array of 20 random integers between 1 and 100. Also, [2.5 marks] find the mean, median and mode of generated numbers.

- (b) Write a Python program to create a function String_Palindrome to check whether a given string [2.5 marks] is palindrome or not. Also, print the total number of characters present in the string.
 For example, String_Palindrome('level')

Output: Yes, the given string is palindrome
 Number of characters: 5

- (c) Write a Python program to make two lists where the first list contains even numbers between 1 [5 marks] and 10 and the second list contains odd numbers between 1 and 10. Merge them to make a nested list. Then, finally, flatten the list without using any built-in function and print the sorted list as output.

First List: [0, 2, 4, 6, 8]

Second List: [1, 3, 5, 7, 9]

Nested List: [[0, 2, 4, 6, 8], [1, 3, 5, 7, 9]]

Final List: [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

- (d) Describe List, Tuple, Dictionary, String and Numpy array. How numpy array is different from [5 marks] list? Explain with example.

UNIT-2

2. (a) What are the different techniques used to train a model? How cost function is useful during training? [2.5 marks]

- (b) Explain Accuracy, Precision, Recall, F1_score and AUC-ROC curve in detail using examples. [2.5 marks]

- (c) What are the different stages of preprocessing of data before using it in a classifier? Explain [5 marks] each step in detail with examples.

- (d) What are different **sampling methods** that can be used to create a training and test set from the [5 marks] available examples? Discuss them in detail. Also, explain sampling bias using an example.

SEM-III

DATA SCIENCE

CBCS Scheme

Mid-Semester Examination Autumn 2023
MCA (Third Semester)
Subject Name: Analysis and Design of Algorithms
Subject Code: CA403103CA

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Time: Two Hours

Note: All the Questions are compulsory.

Max Marks: 30

1. (a) Discuss omega notation with an example. **UNIT-1** [2.5 marks]
- (b) Explain whether the following statement is correct or not. [2.5 marks]
The function $n^3 - 100n^2$ belongs to the set $O(n^2)$.
Also explain your answer.
- (c) Discuss whether the following two statements are correct or not. [5 marks]
(i) $(n + k)^m = \Theta(n^m)$, where k and m are constants
(ii) $2^{n+1} = O(2^n)$
- (d) Use the Master theorem to solve the following recurrences: [5 marks]
(i) $T(n) = 2T(n/2) + n\lg n$
(ii) $T(n) = 7T(n/2) + \Theta(n^2)$

UNIT-2

2. (a) Write two applications of priority queue. [2.5 marks]
- (b) What are the minimum and maximum numbers of elements in a heap of height h ? Explain. [2.5 marks]
- (c) Describe the running time of Build_Min_Heap procedure in building a min heap of a given un-ordered n -elements. [5 marks]
- (d) Given a Max-heap $A = <15, 13, 14, 5, 9, 8, 7, 4, 2>$ of a Max-priority queue, illustrate the results through diagrams when a series of max-priority queue operations, i.e., Extract_Max(A) and Increase_Key($A, 20$) are applied one-by-one. [5 marks]

CBCS Scheme

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Mid-Semester Examination Autumn 2023

MCA (Third Semester)

Subject Name: Computer Network

Subject Code: CA403104CA

Time: Two Hours

Max Marks: 30

Note: (1) All the Questions are compulsory.

- (2) Draw neat and clean diagram wherever required.
(3) Assume suitable data wherever required.

UNIT-1

1. (a) Explain how a Distributed System is Different from Computer Network. [2.5 marks]
- (b) Explain the Design Issues for the Layers. [2.5 marks]
- (c) Explain the following :
 - (i) Network Topology
 - (ii) Protocol
 - (iii) Entities
 - (iv) Connection Oriented Services [5 marks]
- (d) Explain the Difference between OSI Model and TCP/IP Model. [5 marks]

UNIT-2

2. (a) Explain the following :
 - (i) Baseband Coaxial Cable & Broadband Coaxial Cable
 - (ii) Multi-mode Fiber & Single-mode Fiber [2.5 marks]
- (b) (i) What do you understand by Framing?
 (ii) Explain Character Stuffing & Bit Stuffing. [2.5 marks]
- (c) Explain the following:
 - (i) A Simplex Protocol for a Noisy Channel.
 - (ii) Piggybacking [5 marks]
- (d) Explain the following :

(i) Error Correcting Codes	(ii) Error Detecting Codes	(iii) n-bit Codeword
(iv) Hamming Distance		

 [5 marks]

A4 Note Book

CBCS Scheme

Mid-Semester Examination Autumn 2023

MCA (Third Semester)

Subject Name: Compiler Design

Subject Code: CA403105CA

Time: Two Hours

Max Marks: 30

Note: (1) All the Questions are compulsory.

(2) Draw neat and clean diagram wherever required

UNIT-1

1. (a) Why do we need to have lexical analyser generators? What are its advantages? [2.5 marks]
- (b) Explain how use of backpatching allows reduction in the number of passes of a compiler? [2.5 marks]
- (c) How the code $position = initial + rate * 60;$ is pass through different phases of a compiler. What are the issues to be considered in the design of compilers? [5 marks]
- (d) Differentiate between:
 - (i) Lexeme, Token and Pattern. [5 marks]
 - (ii) Compiler and Interpreter

UNIT-2

2. (a) Compute the FIRST and FOLLOW sets for each non-terminal of the grammar given below: [2.5 marks]

$$E \rightarrow E + T / T$$

$$T \rightarrow T * F / F$$

$$F \rightarrow (E) / id$$

- (b) What is the use of LR parsers in compiler design? [2.5 marks]
- (c) Consider the following grammar: [5 marks]

$$S \rightarrow aAC / bB$$

$$A \rightarrow Abc / Abd / e$$

$$B \rightarrow f / g$$

$$C \rightarrow h / i$$

Construct the Predictive Parsing Table for the grammar and check whether the grammars are in LL(1) or not?

- (d) Construct the CLR (1) Parse Table for the grammar and check whether the grammar is in CLR (1) or not. Also show Shift Reduces actions for the Input String " $(i + i)^* i$ ". The given Grammar G is [5 marks]

$$P \rightarrow P + Q / Q$$

$$Q \rightarrow Q * R / R$$

$$R \rightarrow (P) / i$$

SEM-III

DATA SCIENCE

CBCS Scheme

End-Semester Examination 2023
MCA (Third Semester)
Subject Name: Object Oriented concepts & Java
Subject Code: CA403101CA

Time: Three Hours

Note:

Max Marks: 50

UNIT-1

1. (i) Discuss "How to use encapsulation in Java program?".
(ii)

[5 marks]

```
class A {  
    int x;  
}  
class B {  
    public static void main(String args[]) {  
        A ob;  
        ob = new A();  
    }  
}
```

Discuss two lines "A ob;" and "ob = new A();" in the above Java program.

UNIT-2

2. Discuss the use of *super* and *final* keywords through suitable Java programs.

[5 marks]

UNIT-3

3. (a) Explain exception handling mechanism in Java.
[5 marks]
(b) Write a short note on
(i) *isAlive()* (ii) *join()* (iii) *wait()* (iv) *notify()* (v) *notifyAll()*
[5 marks]
(c) Discuss the use of *synchronized method* and *synchronized statement* with a suitable Java program in Java multi-threaded programming. [10 marks]

UNIT-4

4. (a) Write a short note on *ServerSocket* class and *Socket* class in Java networking.
[5 marks]
(b) Write a Java program that will copy the contents of one file into another file using *InputStream* and *OutputStream* abstract classes.
[5 marks]
(c) Write and explain a Java event handling program that implements only *MouseMotionListener* interface in order to handle mouse event.
[10 marks]

4 NOTE BOOK

CBCS Scheme

End-Semester Examination Autumn 2023

MCA (3rd Semester)

Subject Name: Data Science

Subject Code: CA403102CA

Time:

Max Marks: 50

- Note: (1) Draw neat and clean diagram wherever required
(2) Assume suitable data wherever required.

1.

- The sample data set (D1) mentioned below contain following features: "Company", "Color", "Automatic", "Price". 5

Company	Color	Automatic	Price (in lakhs)
Tata Motors	White	Yes	10
BMW	Black	Yes	38
Hyundai	Black		15
Mahindra & Mahindra	Blue	No	12
Kia			10
Toyota	Silver	Yes	11

- Convert the categorical feature into numerical form using "one hot encoding method".
- Check and replace the missing values present in the data set.
- Also print the row where the color is Black and price is between 10 lakhs to 18 lakhs by writing a python script.

UNIT-2

2. (a) What are the different methods of distance computation and where they are used in data science? Explain each method with example. 2.5
(b) How to deal with the non-linear decision boundaries in various learning methods? 2.5

UNIT-3

3. (a) (i) What is Bayes' Theorem and how it is used in naïve Bayes classifier? Explain with examples. 5+5
(ii) What do you understand by the term gradient? Explain different gradient descent methods used to train a model. How can we deal with the challenges of gradient descent learning?
(b) Explain decision tree classifier with example. How a feature is selected from the list of available features for splitting a node? 5
(c) Explain Artificial Neural Network (ANN). How backpropagation works in ANN. 5

UNIT-4

4. (a) What is the difference between crisp set and fuzzy set? How the concept of fuzzy set is utilized in Fuzzy C means clustering algorithm? Explain. How it improves the performance of Fuzzy C means clustering algorithm over K-means algorithm. 10
(b) What is "Curse of dimensionality" in data science? What are the different methods used to deal with the dimensionality issue? Explain PCA using an example. Assume suitable dataset. 5
(c) What are different methods of feature selection? How feature extraction is different from feature selection. 5

A4 Note Book

CBCS Scheme

End-Semester Examination 2023
MCA (Third Semester)
Subject Name: Analysis and Design of Algorithms
Subject Code: CA403103CA

Time: Three Hours

Max Marks: 50

Note:

1. Discuss *Big-oh* and *theta* notation with an example. **UNIT-1** [5 marks]
2. Write insertion sort algorithm. Analyze the best and worse-case running-time of this algorithm with suitable examples. **UNIT-2** [5 marks]
3. (a) Let $G = (V, E)$ be an undirected weighted graph, and let T be a minimum spanning tree in G . Decide whether the following statements are true or false. **UNIT-3** [5 marks]
- (i) For any pair of distinct vertices $s, t \in V$, there is a unique path from s to t in T .
 - (ii) For any pair of distinct vertices $s, t \in V$, the cost of a path between s and t in T is minimal among all paths from s to t in G .

Also justify your answer with an example.

- (b) Let $G = (V, E)$ be a weighted directed graph. The shortest path from a node $s \in V$ to a node $t \in V$ will remain unchanged if:
- (i) Each edge weight $w(v, u)$ is replaced by $C \times w(v, u)$ for a constant $C > 0$.
 - (ii) Each edge weight $w(v, u)$ is replaced by $w(v, u) + C$ for a constant $C > 0$.
 - (iii) Each edge weight $w(v, u)$ is replaced by $w(v, u) - C$ for a constant $C > 0$.
 - (iv) Each edge weight $w(v, u)$ is replaced by $w(v, u)/C$ for a constant $C > 0$.
 - (v) None of the above

Justify your answer to each one.

- (c) A thief enters a house for robbing it. He can carry a maximal weight of 5 kg into his bag. There are 4 items in the house with the following weights and values. What items should thief take if he either takes the item completely or leaves it completely? **[10 marks]**

Items	Weight (Kg)	Value (\$)
1	2	3
2	3	4
3	4	5
4	5	6

UNIT-4

4. (a) Explain "How does a counting sort algorithm work differently from a comparison-based sorting algorithm?" **[5 marks]**
- (b) Illustrate the operations of Radix-Sort on a given input, i.e., four 3-digit numbers $<954, 354, 009, 411>$ through diagrams. Also, write a C program (or pseudo-code) for Radix-Sort algorithm on this same input. **[5 marks]**
- (c) Write a short note on P, NP, NP-Complete and NP-Hard problems. **[10 marks]**

A4 Note Book

CBCS Scheme

End-Semester Examination Aut... 2021

MCA (Third Semester)

MCA (Third Semester)
Subject Name: Computer

Subject Name: Computer Network
Subject Code: CA1101

Time: Three Hours

Max Marks: 50

Note: (1) All the Questions are compulsory.

(2) Draw Neat and Clean Diagrams.

(3) Assume S is a set.

LITERATURE

- UNIT-1

UNIT-2

2. (a) Write Short Notes on the following (ANY TWO) [5 marks]

 - I. Cyclic Redundancy Code
 - II. Flow Control and Error Control
 - III. Selective Repeat ARQ Protocol
 - IV. A Protocol using Go Back n

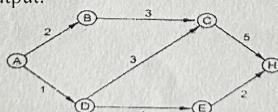
UNIT-3

3. (a) Compare Virtual Circuits and Datagram Subnet. [5 marks]

(b) 1. Explain Various Classes of IP Addresses and Find Netid and Hostid for the following IP: [3 marks]
(i) 19.34.21.5 (ii) 201.2.4.2 (iii) 241.240.200.2

2. Explain Congestion. [2 marks]

(c) Find the Short Path between Node A and Node H for the following figure by applying Dijkstra Algorithm. Explain each step output. [10 marks]



UNIT-4

4. (a) Explain in brief about Plain Text, Cipher Text, Public Key and Private Key in Cryptography. [5 marks]

(b) Explain the following Terms with reference to Network Security [5 marks]
(i) Secrecy (ii) Authentication (iii) Non repudiation (iv) Integrity Control

(c) 1. Write the process of RSA Algorithm for Encryption and Decryption of Data. For the given $p=3$, $q=11$, and $d=7$, write the process of Encryption and Decryption of the Plain Text "NIT" using RSA Algorithm. [6 marks]

2. Explain the following terms (Any Two): [4 marks]
(i) Domain Name Space (ii) Domain Name System (iii) Digital Signature

CBCS Scheme

End-Semester Examination Autumn 2023
MCA (Third Semester)

Time: Three Hours

Subject Name: Compiler Design (CA403105CA)

Max Marks: 50

Note: (1) All the Questions are compulsory.
(2) Draw neat and clean diagram wherever required.
(3) Assume suitable data wherever required.

UNIT-1

1. (a) What is the difference between Syntax Analysis and Semantic Analysis? Give [2.5 marks] an example each for an error found by the compiler during Syntax Analysis and Semantic Analysis with reference to C programming.
- (b) What is a 'Pass' in a compiler? Differentiate between a Multi-Pass Compiler [2.5 marks] and a Single-Pass Compiler.

UNIT-2

2. Construct a LALR(1) Parse Table for the grammar [5 marks]
$$\begin{aligned} S &\rightarrow Aa / aAc / Bc / bBa \\ A &\rightarrow d \\ B &\rightarrow d \end{aligned}$$

And list out the drawbacks of LR parser in context of compiler design.

UNIT-3

3. (a) What is Runtime Environment? What are the important elements of Runtime Environment? How is it controlled in a program that is compiled? [5 marks]
- (b) What is an Activation Record? With the help of a diagram, show the important fields in an Activation Record. [5 marks]
- (c) What are Parameter-Passing Techniques? List out the main advantages of using Parameter-Passing Techniques. Explain any THREE Parameter Passing mechanisms with an example. [5 marks]
- (d) Describe the Three Address Code (TAC) form of the Intermediate Code. [5 marks]
Compare the different methods of implementing Three Address Code.

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UNIT-4

4. (a) What are the common techniques for improving the Intermediate Code? [5 marks]
- (b) What is a Peephole Optimization? Explain any four methods used in Peep-Hole Optimization, justifying the improvement in performance or memory usage. [5 marks]
- (c) Consider the following Three Address Code statements: [5 marks]

(1) $i = m - 1$
(2) $j = n$
(3) $t1 = 4 * n$
(4) $v = a[t1]$
(5) $i = i + 1$
(6) $t2 = 4 * i$
(7) $t3 = a[t2]$
(8) if $t3 < v$ goto (5)
(9) $j = j - 1$
(10) $t4 = 4 * j$
(11) $t5 = a[t4]$
(12) if $t5 > v$ goto (9)
(13) if $i \geq j$ goto (23)
(14) $t6 = 4 * i$
(15) $x = a[t6]$

(16) $t7 = 4 * i$
(17) $t8 = 4 * j$
(18) $t9 = a[t8]$
(19) $a[t7] = t9$
(20) $t10 = 4 * j$
(21) $a[t10] = x$
(22) goto (5)
(23) $t11 = 4 * i$
(24) $x = a[t11]$
(25) $t12 = 4 * i$
(26) $t13 = 4 * n$
(27) $t14 = a[t13]$
(28) $a[t12] = t14$
(29) $t15 = 4 * n$
(30) $a[t15] = x$

and compute the following:

- (i) Construction of Flow Graph
(ii) Optimize the above Flow Graph for Common Sub- Expression Elimination and Copy Propagation.

- (d) What is Register and Address Descriptor? Define the role of Register and Address Descriptor in Target Code Generation? [5 marks]
