

2023

Department of Computer Science, CUSAT, Kochi

M.Sc Computer science, (Five year Integrated), First Semester IInd

Internal Examination

23-813-0105:Environmental studies

Total marks:20

Time:2hrs

I Choose the correct answer from the options given (4x1=4)

1. The main components of photochemical smog is

- a)sulphur dioxide
- b)water vapour
- c)oxides of nitrogen
- d)all of the above

2.Sound becomes hazardous noise pollution at decibels

- a)above 30
- b)above100
- c)above80
- d)above120

3.Which of the following are the example of municipal and industrial discharge pipes

- a)nonpoint sources of pollution
- b)violations of the clean water act
- c)point sources of pollution
- d)irrigation

4.Which of the following is not a secondary air pollutant

- a)ground level ozone
- b)peroxy acetyl nitrate
- c)VOCs
- d)carbon monoxide

II Answer the following questions (3x2=6)

- 5.What do you mean by greenhouse effect? Name two greenhouse gases.
- 6.What is acid rain? Explain its adverse effects.
- 7.What is radiation pollution?
- III. Answer any two questions (2x5=10)
- 8.Define air pollution. Briefly explain the types of air pollutants, adverse effects and control measures.
- 9.What is meant by ozone layer? What is its significance? Explain ozone layer depletion and its consequences.
- 10.What is solid waste management? Briefly discuss the methods of solid waste management and the control measures for industrial waste.

SFI DCS

Mathematics for Data Science

Duration: 2 hour

Max Marks: 20

1. i) Define a Tree? Which of these graphs are trees?

i)

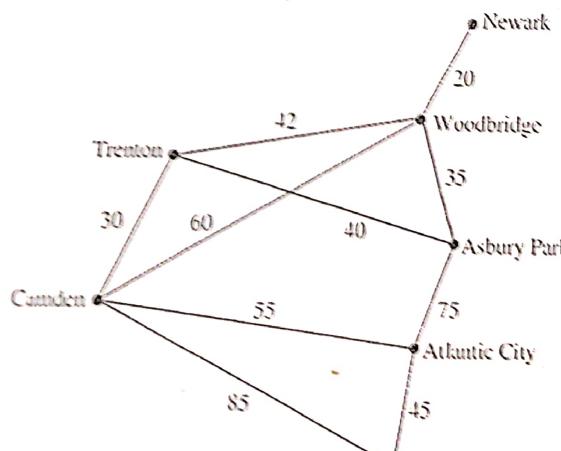


ii)



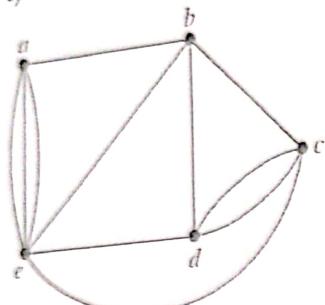
II) State planar Graphs. Give two constructions for the planar graphs. (5 marks)

2. The weighted graphs below , show some major roads in New Jersey. It shows the distances between cities on these roads .Find a shortest route in distance between Newark and Camden, and between Newark and Cape May, using these roads.

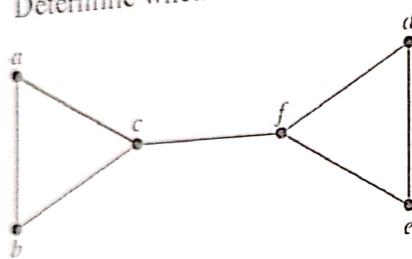


(a)

3. Explain Königsberg bridge problem.
 i) Determine whether the graph has an Euler Circuit.

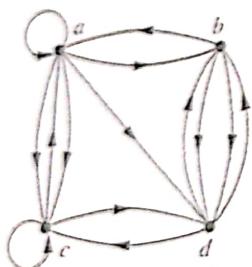


- ii) Determine whether the given graph has a Hamilton circuit.

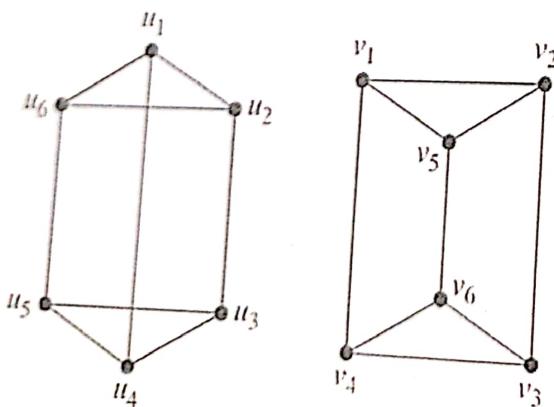


(5 marks)

3. i) Find the adjacency matrix of the given directed multigraph with respect to the vertices listed in alphabetic order.



- ii) Check Whether the graphs are Isomorphic?



5 marks



Cochin University of Science and Technology
Department of Computer Science

First Semester M.Sc. (Five Year Integrated) in Computer Science (Artificial Intelligence & Data Science)
Second Series Examination - November 2023

21-805-0103: Object Oriented Programming

Duration: 2 Hours

Maximum Marks: 20

Course Outcome

SI No	Description
CO1	Understand the procedural and object oriented paradigm with concepts of streams, classes, functions, data and objects
CO2	Understand dynamic memory management techniques using constructors and destructors.
CO3	Describe the concept of Inheritance, function overloading, operator overloading, virtual functions and polymorphism
CO4	Understand the usage of templates, generic programming, exception handling and dynamic objects.
CO5	Demonstrate the use of various OOPs concepts with the help of programs

Course Outcome	Bloom's Taxonomy Level (BTL)					Total Marks
	BTL1 Remembering	BTL2 Understanding	BTL3 Applying	BTL4 Analysing	BTL5 Evaluating	
CO1						
CO2	10					10
CO3		4	6			10
Total Marks	10	4	6			20

Name of faculty :

Signature:



First Semester M.Sc. (Five Year Integrated) in Computer Science (Artificial Intelligence & Data Science)

Second Series Examination - November 2023

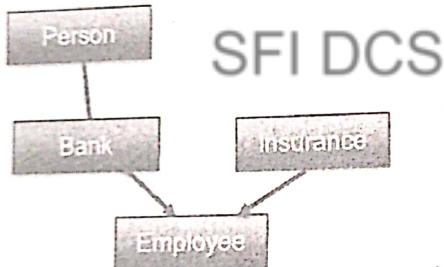
21-805-0103: Object Oriented Programming

Maximum Marks: 20

Duration: 2 Hours

Answer all questions.

1. Explain the Hierarchical Inheritance with help of suitable C++ Programs. What is the scope and application of this inheritance? [4 Marks] [CO3, DL-2, BTL-2]
2. With proper C++ code as example illustrate different types of constructors. What is the scope of copy constructor? Why dynamic constructor is used? Which method is used to relocate all the memory used by constructor? [4 Marks] [CO2, DL-2, BTL-1]
3. What is the relevance of Type conversions in C++? Explain different type casting with suitable codes and programs? [3 Marks] [CO2, DL-1, BTL-1]
4. Illustrate Operator overloading with suitable example? [3 Marks] [CO2, DL-1, BTL-1]
5. Write C++ program for the following. What kind of inheritance is this?



Person works in Bank and another insurance company same time. He will get payment from Bank and Insurance company as Employee. Using proper methods and properties in respective classes, print Person PAN No, Employee No, Bank Salary, Insurance Company Salary and Total Salary.

(Bank Sal = BP + 60 % DA-Tax%) (Insurance Sal = Hours worked * 1000) (Input BP, Tax%, Hours worked from key board) [6 Marks] [CO3, DL-3, BTL-3]

Internal Test Paper

Mathematics for Data Science

1st Semester Integrated M.sc Computer Science

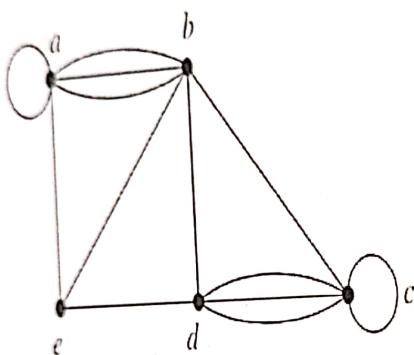
Total Marks: 20

- 1.
- Let $A = \{a, b, c\}$, $B = \{x, y\}$, and $C = \{0, 1\}$. Find
 - $A \times B \times C$.
 - $C \times B \times A$.
 - Find the sets A and B if $A - B = \{1, 5, 7, 8\}$, $B - A = \{2, 10\}$, and $A \cap B = \{3, 6, 9\}$.
 - State and Prove De Morgan Laws?
 - Find $\bigcup_{i=1}^{\infty} A_i$ and $\bigcap_{i=1}^{\infty} A_i$ if for every positive integer i ,
 - $A_i = \{-i, -i+1, \dots, -1, 0, 1, \dots, i-1, i\}$.
 - $A_i = \{-i, i\}$
- (5 marks)
- 2.
- Prove that for every positive integer n , $1.2 + 2.3 + \dots + n(n+1) = \frac{n(n+1)(n+2)}{3}$, by the method of Principle of Mathematical Induction.
 - Seven women and nine men are on the faculty in the mathematics department at a school. a) How many ways are there to select a committee of five members of the department if at least one woman must be on the committee?
b) How many ways are there to select a committee of five members of the department if at least one woman and at least one man must be on the committee?
 - What is the conditional probability that a randomly generated bit string of length four contains at least two consecutive 0s, given that the first bit is a 1? (Assume the probabilities of a 0 and a 1 are the same.)
 - What is the expected number of heads that come up when a fair coin is flipped 3 times?
- (5 marks)
- 3.
- Define a relation. Give an example of a relation on a set that is
 - both symmetric and antisymmetric.
 - Let R be the relation $\{(1, 2), (1, 3), (2, 3), (2, 4), (3, 1)\}$, and let S be the relation $\{(2, 1), (3, 1), (3, 2), (4, 2)\}$. Find $S \circ R$.
 - Consider the equivalence relation on set of real numbers, $R = \{(x, y) \mid x - y$ is an integer $\}$.

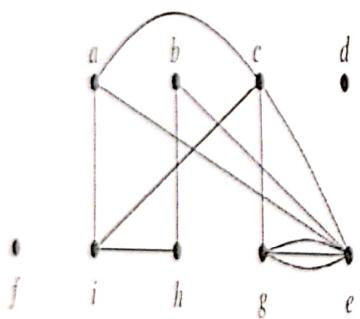
- a) What is the equivalence class of 1 for this equivalence relation?
 b) What is the equivalence class of 1/2 for this equivalence relation?
 d) Define partial ordering of a set. Which of these relations on $\{0, 1, 2, 3\}$ are partial orderings?
 1) $\{(0, 0), (1, 1), (1, 2), (1, 3), (2, 2), (2, 3), (3, 3)\}$
 2) $\{(0, 0), (0, 1), (0, 2), (1, 0), (1, 1), (1, 2), (2, 0), (2, 2), (3, 3)\}$

(5 marks)

4. i. Define a Graph. Find the sum of the degrees of the vertices of each graph and verify that it equals twice the number of edges in the graph.



SFI DCS



Can a simple graph exist with 15 vertices each of degree five?

- ii. Draw these graphs.

- a) K_7 b) $K_{1,8}$ c) $K_{4,4}$ d) C_7 e) W_7 (5 marks)

Cochin University of Science and Technology, Kochi
Department of Computer Science
M.Sc. (Five Year Integrated) Programme in Computer Science
First Internal Examination, October 2023

21-805-0103: Object Oriented Programming

Total Marks: 20

Time: 2 Hours

1. Explain the concept of arrays in C++ with suitable example?
A Bank keeps two arrays to store customer's PAN numbers. Write a C++ program to compare two arrays and store the matching PAN numbers to another array (3 Marks)
2. What is structure in C++. With Suitable example explain how structures are implemented in C++ (2 Marks)
3. Illustrate function overloading in C++. Brief the benefits of function overloading? (3marks)
4. Write C++ program for the following
Create a Class – Employee
Properties: emp_id, Age, name
Method : int sal(int bp, float allowance)
Method should return salary by deducting 10% tax of total sal (bp+allowance)
Input emp_id, Age ,Name ,bp and allowance.
Print salary slip (ID, Name, Salary) (4 Marks)
5. Exemplify the features OOPS? What are the benefits of Object Oriented programming when compared to the Procedure Oriented Programming? (4 Marks)
6. What is a constructor in OOPS? What are benefits of using Constructor?
Explain the scope and use of constructor with suitable C++ program? (4 Marks)

**First Semester Integrated M.Sc. In Computer Science (Artificial Intelligence and Data Science)****End Semester Examination - November 2023****23-813-0102: Communicative English**

Duration: 3 Hours

Maximum Marks: 50

SECTION A (Reading)*Answer all questions. Each question carries 1 mark.***Read the following passage and answer the following question.**

For many students, exams seem a necessary evil. Time-consuming yet inevitable. But are exams really necessary? And are they evil?

Rather than abolishing exams, we should instead be asking what mix of assessment tasks is most appropriate for each subject. Where might exams fit? And what are their benefits?

In most disciplines, there are specific bodies of knowledge that students are expected to learn. Exams enable us to accurately test student's breadth of understanding of these topics.

Exams are also useful for a very different reason: they are harder than essays to cheat on. Drawing on our characteristics of good assessment, it is impossible to provide a balanced, fair evaluation of a student's performance if the student has paid someone else to complete their work for them.

Finally, and on a more positive note, there is evidence that both studying for and sitting exams deepen learning. Studying is like exercising. When one exercises, the muscles in use grow stronger. Likewise, the process of searching through ones memory and retrieving the relevant information strengthens that memory pathway for future uses. This means that when newly qualified teachers, doctors, lawyers, or accountants come to retrieve information they need, it is – a consequence of having been practised previously- now easier to access.

So, how can we best make use of this 'practice effect' for memory? Research tells us that learning is particularly strong when students self-test. Rather than passively reading and remembering by rote, we want our students to study by forming appropriate questions, searching memory for relevant responses, and knitting this information together into an appropriate answer.

We think this third benefit of exams is the most exciting. Exams don't just provide a targeted, fit-for-purpose opportunity for students to demonstrate what they know: they also have the power to enhance what students know.

- 1) What questions does the author try to answer in the passage? (CO-4, D-2, BTL-2)
- 2) How can you improve assessment systems? (CO-4, D-2, BTL-2)
- 3) Why does the author prefer exams to essays for student evaluation? (CO-4, D-2, BTL-2)
- 4) What is the best study technique according to the author? (CO-4, D-2, BTL-2)
- 5) What is the most exciting benefit of an exam? (CO-4, D-2, BTL-2)
- 6) Which word in the passage means 'that which cannot be avoided'?
- a) targeted
 - b) appropriate
 - c) relevant
 - d) inevitable (CO-1, D-1, BTL-2)
- 7) The word which is closest in meaning to 'result' is:
- a) Consequence
 - b) Benefit
 - c) Opportunity
 - d) evidence (CO-1, D-1, BTL-2)
- 8) The phrase 'to cheat on' in the passage means:
- a) To commit adultery
 - b) To break the rules of something
 - c) Both a and b
 - d) To steal (CO-2, D-1, BTL-2)
- 9) Identify the statement which is not true
- a) Exams help in testing the subject knowledge of students
 - b) Exams should be modified according to the subject
 - c) Exams enhance memory and retrieval of information.
 - d) None of the above (CO-4, D-, BTL-2)
- 10) The phrase 'by rote' means :
- a) By hook or by crook
 - b) By mechanical repetition
 - c) By reading and writing
 - d) Through analysis (CO-1, D-1, BTL-1)

(1 x 10 = 10 marks)

SECTION-B (Writing)

Attempt any six questions. Each question carries 5 marks

11. Draft a CV for the post of an app developer in a renowned firm. You are Rohit/Rania, a recent graduate from IIT- Kanpur. (CO-3, D-2, BTL-3)
12. Write a covering letter for the post of an animator in a well-renowned studio. (CO-3, D-2, BTL-3)
13. Write a blog post on the importance of physical activity in academic performance. Create an appropriate title for the same. (CO-1, D-2, BTL-3)
14. Write a magazine report for your college magazine on the inauguration of an inter-collegiate sports fest. (CO-1, D-2, BTL-3)
15. Write minutes of a meeting convened concerning Literary Fest in your college. You are the secretary of the official book club in your college. (CO-4, D-2, BTL-2)

16. Write two words which mean
a) 'two' or 'a bane.'
b) 'massive amount' or 'increase in
india.'

16. Write two to three paragraphs of around 250-300 words on 'Social media; a boon or a bane.' (CO-4, D-2, BTL-2)

17. Massive amounts of firecrackers burst during the festive season has led to an increase in pollution in your locality. Residents have been advised to remain indoors and wear N-95 masks when outdoors. Write a letter to the editor of the news daily, 'The Hindu' urging the local authorities to take appropriate steps to ensure clean and breathable air in the city. State reasons why it is important and clarify why clean air is good for the residents and its productivity. You are Mikha/Michael resident of House no.26/10, Garden City, Kochi.(CO-1, D-2, BTL-3)

18. Write a letter to your best friend who is studying in Christ College, Bangalore about the blood donation drive conducted in your college. Emphasize the need to donate blood, illustrate about the grandiose with which your college is celebrating this donation drive. You are Diana/ Daniel of CUSAT Hostel No. 4, Kalamassery road, Kerala.(CO-1,D-2,BTL-3)

(5x 6= 30 marks)

SECTION – C (GRAMMAR)

Answer all questions. Each question carries 1 mark

19. 15th august isin the history of India. (Pick the correct idiomatic phrase) (CO-2, D-1, BTL-1)

a) In the good books

b) a red letter day

c) At the finger tips

d) made good

20. I told the candidate, 'we will publish the results tomorrow.' (Change into indirect speech) (CO-2, D-1, BTL-3)

21. The peon opened the gate. (Change into passive voice) (CO-2, D-1, BTL-3)

22. The early bird catches the worm. (Identify subject and predicate) (CO-2, D-1, BTL-2)

23. Pablo Picasso is a renowned painter. (Identify proper noun and common noun) (CO-1, D-1, BTL-1)

24. Rahul made twelve runs. He was caught at the wicket. (Join the sentences using a suitable conjunction) (CO-2, D-1, BTL-2)

25. Ooty isthan Chennai (add a suitable comparative or superlative adjective) (CO-2, D-1, BTL-2)

26.! You made it to the final round of the quiz competition. (Add a suitable interjection) (CO-2, D-1, BTL-2)

27. We went.....the beach.....car. (Fill in the blanks with a suitable preposition) (CO-2, D-1, BTL-2)

28. The baron has a gold watch in his pocket. (Rewrite the sentence by changing the gender in the sentence) (CO-2, D-1, BTL-2)

(1 x 10 = 10 marks)

M.Sc (Five Year Integrated) Programme in Computer Science
First Internal Examination, October 2023

21-805-0104 Computational Thinking for Problem Solving

Total marks: 20

Time: 2 hrs

1. Draw a flow chart that reads a number n , followed by n positive numbers, and prints the maximum and minimum of those n numbers. [3 marks]
2. You are given a pseudocode for an algorithm to search for a *target* in *array*. Check for any mistakes in the algorithm and correct them (if any). Explain the logic behind your corrections.

```
1. Search (array, target){  
2.   Found = FALSE  
3.   for i from 1 to length(array) {  
4.     if (array[i] == target)  
5.       Found = TRUE  
6.     else:  
7.       Found = FALSE  
8.   }  
9.   if (Found == TRUE)  
    Print "Target Found"  
10.  else  
    Print "Target Not Found"  
11. }
```

[4 marks]

3. Using a truth table, find out if the proposition $(p \vee \neg q) \wedge (q \vee \neg r) \wedge (r \vee \neg p)$ is satisfiable. [2 marks]
4. These are some of the requirements of a conventional oven specified by the manufacturer. Translate these into propositional logic statements:
 - a. The oven light is on when the oven is in use.

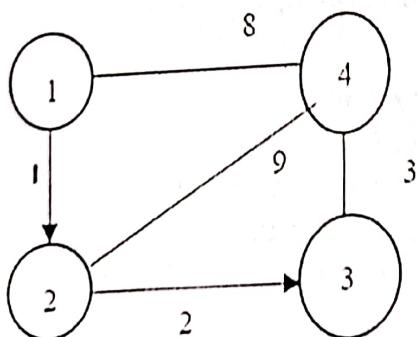


- b. The oven will self-clean if and only if the temperature is set to 500 degrees, and the timer is set to 4 hours
- c. The oven light will remain on while the oven is in use, except when the oven is in the self-cleaning mode [6 marks]

5. Using inference rules, prove the statement 'not p' from these premises:
- $q \rightarrow (p \rightarrow r)$
 - $\neg r$
 - q
- [3 marks]

6. Given below is a graph showing roads connecting 4 cities with distance given in miles. Arrows indicate one-way ONLY roads. Represent this data in the form of a matrix. Use -1 to indicate no road. [2 marks]

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Cochin University of Science and Technology

Department of Computer Science

Department of
M. Sc.

First Semester M.Sc. (Five Year Integrated) in Computer Science (Artificial Intelligence & Data Science)
Second Series Examination - November 2023

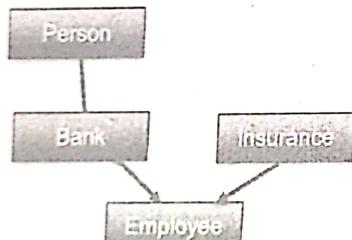
21-805-0103: Object Oriented Programming

Maximum Marks: 20

Duration: 2 Hours

Answer all questions.

1. Explain the Hierarchical Inheritance with help of suitable C++ Programs. What is the scope and application of this inheritance? [4 Marks] [CO3, DL-2, BTL-2]
2. With proper C++ code as example illustrate different types of constructors. What is the scope of copy constructor? Why dynamic constructor is used? Which method is used to relocate all the memory used by constructor? [4 Marks] [CO2, DL-2, BTL-1]
3. What is the relevance of Type conversions in C++? Explain different type casting with suitable codes and programs? [3 Marks] [CO2, DL-1, BTL-1]
4. Illustrate Operator overloading with suitable example? [3 Marks] [CO2, DL-1, BTL-1]
5. Write C++ program for the following. What kind of inheritance is this?



Person works in Bank and another insurance company same time. He will get payment from Bank and Insurance company as Employee. Using proper methods and properties in respective classes, print Person PAN No, Employee No, Bank Salary, Insurance Company Salary and Total Salary.

(Bank Sal = BP + 60 % DA - Tax%) (Insurance Sal = Hours worked * 1000) (Input BP, Tax%, Hours worked from key board)

[6 Marks] [CO3, DL-3, BTL-3]



Cochin University of Science And Technology
Department of Computer Science

**First Semester M.Sc. (Five Year Integrated) in Computer Science
(Artificial Intelligence & Data Science)**

Second Internal Examination - November 2023

21-S05-0104 Computational Thinking for Problem Solving

Duration: 2 Hours

Maximum Marks: 20

Answer all questions.

1. What is abstraction? Give an example of abstraction in real life.
[2 marks][CO3, DL-1, BTL-2]
2. (a) Find the equivalent decimal (base 10) number for the binary numbers 10011 and 11000
(b) Give the binary equivalent for the decimal numbers 256 and 192.
[4 marks][CO1, DL-2, BTL-2]
3. Consider a song that is two minutes long and is sampled at a rate of 24 kHz for recording on a digital audiotape. We will assume that a sample is encoded as an 8-bit string. How many bits are required to store this song without compression?
[3 marks][CO1, DL-2, BTL-3]
4. Consider a Video Player, a computer application that plays a video with buttons that allow the user to play or pause the video, as well as to raise or lower the sound volume.
 - a. Write down the four functional requirements for this application.
 - b. Identify the states and activities (user actions) for the application
 - c. Construct a state-activity table that lists all possible application states against all possible user actions.
[6 marks][CO4, DL-2, BTL-3]
5. Discuss the concept of *decomposition* in problem-solving. How can you apply decomposition to efficiently search for a given number s in a sorted list of 16 integers? Write an algorithm for the same.
[5 marks][CO4, DL-2, BTL-3]

ENGLISH INTERNAL ASSESSMENT- I
DEPARTMENT OF COMPUTER SCIENCE
Integrated M. Sc. (Semester- 1)

OCT 2023

Time: 2 Hours

Max. Marks:
20 marks

- 1) Read the following passage and complete the exercises that follow:

Raman was a voracious reader and pored eagerly over all books in his father's collection, among which were the original writings of great scientists. These books were to him like old friends, never to be forgotten. He once said, 'out of this welter of subjects and books, can i pick anything really to mould my mental welter of subjects and books, can i pick anything really to mould my mental and spiritual outlook and determine my chosen path? Yes, i can and shall mention three books.' these three were Edwin Arnold's *Light of Asia*, which is the story of gautam Buddha, *The Elements of Euclid*, a treatise on classical geometry, and *the sensations of tone*, by german scientist helmholtz, on the properties of sound waves. A study of his manner of working, the problems he chose to work on and the nature of the solutions he discovered does appear to carry the mark of these great minds.

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- a)in the passage means 'highly enthusiastic'.
- b) Welter means.....i) shelf ii)arrangement iii)confused mass iv)room
- c) Which were the books that influenced Raman?
- d)The word from the passage is an antonym of 'fake'
- e) 'Pored eagerly over' means..... i)read with great interest ii) studied carefully iii)both i and ii iv) skimmed through

(5 marks)

- 2) Draft the format of note making and list out at least three of its importance.

(5 marks)

3) Imagine you have organized a food fest in your college. Write a letter to your friend sharing your experiences with him/ her.

(5 marks)

4) Answer as directed.

- i) find subject and predicate - The early bird catches the worm.
- ii) find the noun and state its type - Jawaharlal Nehru was the first Prime Minister of India.
- iii) supply suitable adjective – His.....manners have endeared him to all.
- iv) Supply with suitable comparative or superlative adjective - That is the.....price I can take.
- v) Fill in the blanks with suitable articles -honest man isnoblest work of God.

(5 marks)

SFI DCS

DEPARTMENT OF COMPUTER SCIENCE
Cochin University of Science and Technology
M.Sc. (Five Year Integrated) in Computer Science (AI & DS)
First Semester
21-S05-0103: Object Oriented Programming
Second Series Examination, March 2023

Time: 2 hours

Answer All Questions

Maximum Marks: 20

1. Create a class *MAT* which contains a matrix data member of size $m \times n$. Write a C++ program to overload + and * operators to add and multiply two *MAT* objects, respectively. Use dynamic memory allocation for the matrix with the help of constructors. [7]
2. With the help of a C++ program explain how one class type is converted to another using casting operator function. [3]
3. What are virtual base classes? Explain with the help of a C++ program. [3]
4. Create a class *account* that stores customer name, account number and type of account. From this derive the classes *cur_acct* and *sav_acct* to make them more specific to their requirements. Include necessary member functions to achieve the following tasks:
(a) Accept deposit and update balance.
(b) Display balance.
(c) Compute and deposit interest.
(d) Permit withdrawal and update balance.
(e) Check for the minimum balance, impose penalty if necessary and update balance. [7]



IMSc End Sem Exam (1st Sem)

Cochin University of Science and Technology

Department of Computer Science

21-805-0101 Mathematics for Data Science

End Semester Examination, Date: April 03, 2023

Timing: 09:30 to 12:30 Noon

I Semester

Max mark: 50

Attempt Five Questions

1. (a) For all $n > 1$, prove that $1 + 4 + 7 + \dots + (3n - 2) = \frac{n(3n-1)}{2}$ (5)

(b) Suppose X is a random variable representing the number of heads in a throw of 5 fair coins. Calculate and plot the probability distribution. (5)

OR

2. (a) What are sum rule and product rule of probability? Consider joint of two random variables (for example symptom and disease with some probability values). Illustrate the use of sum and product rules in computing various probabilities. (5)

(b) Present the *Birthday Paradox* problem. How the paradox is resolved? (5)

3. (a) Describe Konigsberg bridge problem. Illustrate with necessary details the solution proposed by Euler. (7)
SFI DCS
(b) What is Isomorphism in graphs? Give an example. (3)

OR

4. (a) Illustrate minimum spanning tree algorithm with an example graph consisting at least 5 vertices. (7)

(b) Give methods to enumerate spanning trees of a given graph. (3)

5. (a) If the angle between two non-zero vectors u and v is θ , then prove that

$$\cos(\theta) = \frac{u \cdot v}{|u||v|}$$

Also how is this angle related to the cross product of u and v ? (5)

(b) Explain the parametric and vector equation of a line? Find the equation of the plane through $(1, 1, -1)$, $(2, 0, 2)$, and $(0, -2, 1)$ (5)

OR

6. (a) Find the derivative of the following vector-valued function (5)

1. $\vec{r}(t) = (t^3 - 1)\vec{i} + e^{2t}\vec{j} + \cos(t)\vec{k}$

2. $\vec{r}(t) = \left\langle \frac{t+1}{t-1}, \tan(4t), \sin^2(t) \right\rangle$

(b) Find the integrals of the following vector-valued function (5)

1. $\int \vec{r}(t) dt$ where $\vec{r}(t) = t^3 \vec{i} - \frac{2t}{t^2+1} \vec{j} + \cos^2(3t) \vec{k}$
2. $\int \vec{r}(t) dt$ where $\vec{r}(t) = \langle 6, 6t^2 - 4t, te^{2t} \rangle$

7. (a) Find all first and second-order partial derivatives of (5)

1. $f(x, y) = y^3 x^2$
2. $w = x^2 y - 10y^2 z^3 + 43x - 7 \tan(4y)$

(b) 1. Find the directional derivative of $f(x, y) = \ln(2xy) - \sin(x^2 + y^2)$ in the direction of $\vec{v} = \langle 7, -3 \rangle$
2. Find the maximum and minimum values of $f(x, y, z) = x^2 + 3y^2$ subject to the constraint $x^2 + 4y^2 + z^2 = 36$

(5)

OR

8. (a) Using chain rule find w_p and w_q for

$$w = x^2 y^4 z^6 - 2xy \quad x = 2p, \quad y = 3tq, \quad z = 3tp^2, \quad q = 2t$$

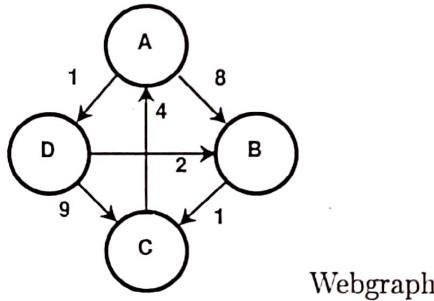
(4)

(b) Find

1. $f_{xxyz} \text{ for } f(x, y, z) = z^3 y^2 \ln(x)$
2. $\frac{\partial^3 f}{\partial y \partial x^2}$ for $f(x, y) = e^{xy}$

(6)

9. (a) Given a webgraph shown below, Compute the All pairs shortest path using Floyd-Warshall algorithm. Show all steps of computing (7)



(b) Explain any real-life situation where vector addition can be explained ? (3)

OR

10. (a) Formulate the problem of the computing page rank of word wide web. For the above Webgraph, illustrate how to compute page rank (6)

(b) Every dataset with 'n' features can be consider as a subset of R^n . Explain validity of the statement (4)

DEPARTMENT OF COMPUTER SCIENCE
Cochin University of Science and Technology
M.Sc. (Five Year Integrated) in Computer Science (AI & DS)
End Semester Examination, April 2023

21-805-0103: Object Oriented Programming

Time: 3 hours

Maximum Marks: 50

Module I

1. (a) Write a C++ program to evaluate the following function to 0.0001% accuracy. [6]

$$\cos(x) = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$$

- (b) With the help of an example program explain the use of static data members in C++. [4]

OR

2. (a) Write a class to represent a vector (a series of float values). Include member functions to perform the following tasks:

- (i) To create the vector objects using constructors.
- (ii) To modify the value of a given element.
- (iii) To multiply by a scalar value.
- (iv) To display the vector object.

- (b) Comment on copy constructors and dynamic constructors. Give examples. [4]

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Module II

3. (a) What is containership? How it differs from inheritance? Explain with examples. [4]

- (b) The class *master* derives information from both *account* (with data member *pay*) and *admin* (with data member *experience*) classes which in turn derive information from the class *person* (with data members *name* and *code*). Define all the four classes and write a C++ program to create, update and display the information contained in *master* objects. [6]

OR

4. (a) Illustrate how constructors of base and derived classes are invoked with the help of an example program. [4]

- (b) When do we use the *protected* visibility specifier to a class member? Give examples. [4]

- (c) How do the properties of the following two derived classes differ?

- (i) class D1: private B{ };
- (ii) class D1: public B{ };

[2]

Module III

5. (a) With the help of an example C++ program show how a class type can be converted to a basic type using conversion function. [5]

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- (b) Define a class *strings*. Use overloaded $==$ operator using friend function to compare two *strings* objects.

OR

6. (a) Write a C++ program to overload a $+$ operator using member function to add two *time* objects with data members *hours*, *minutes* and *seconds*. [6]
(b) Explain the two ways in which a class type can be converted to another class type. [4]

Module IV

7. (a) What is the use of *this* pointer? Explain with the help of a C++ program. [4]
(b) What are pure virtual functions? Explain its use. [2]
(c) How is polymorphism achieved at compile time and run time.

OR

8. (a) What is a virtual function? Why do we need it? Explain using a C++ program. [6]
(b) Differentiate between a pointer to an array of objects and an array of pointer objects with examples. [4]

Module V

9. (a) Write a C++ program using templates to create *int*, *float* and *double* objects of a class *vector*. Implement the necessary member functions to:
(i) Create a vector object.
(ii) Display a vector object.
(iii) Compute the magnitude of a vector object. [6]
(b) Write a C++ program to demonstrate how to handle *division - by - zero* exception in a division operation. [4]

OR

10. (a) Write a C++ program to demonstrate the use of *throw* statement in exception handling. [5]
(b) What are function templates? Explain with the help of a C++ program. [5]

Cochin University of Science and Technology

Department of Computer Science

M.Sc. (Five Year Integrated) in Computer Science

(Artificial Intelligence & Data Science)

End Semester Examination - April 2023

21-805-0102: Communicative English

MAXIMUM MARKS: 50

DURATION: 3 HOURS

SECTION A READING

Answer all questions. Each question carries 1 mark.

Read the following passage and answer the questions that follow:

For many years now, the governments have been promising the eradication of child labour in hazardous industries in India. But the truth is that despite all the rhetoric, no government so far has succeeded in eradicating this evil, nor has been able to ensure compulsory primary education for every Indian child. Between 60 and 100 million children are still at work instead of going to school, and around 10 million are working in hazardous industries. India has the biggest child population of 380 million in the world, plus the largest number of children who are forced to earn a living. We have many laws that ban child labour in hazardous industries. According to the Child Labour (Prohibition and Regulation) Act, 1986, the employment of children below the age of 14 years, in hazardous occupations, has been strictly banned. But each State has different rules regarding the minimum age of child employment. This makes implementation of these laws difficult.

Also, there is no ban on child labour in the non-hazardous occupations. The Act applies to the organised or factory sector and not the unorganised sector where most children find employment as cleaners, servants, porters, waiters, etc., among other forms of unskilled work. Thus, child labour continues because the implementation of the existing laws is lax. There are industries which have a special demand for child labour because of their nimble fingers, high level of concentration and capacity to work hard at abysmally low wages. The carpet industry in U.P. and Kashmir employs children to make hand-knitted carpets. Industries like gem-cutting and polishing, pottery and glassmaking want to remain competitive by employing children. The truth is that it is poverty which is pushing children into the labour market. We have 260 million people below the poverty line in India, many of them are women. Poor and especially woman-headed families, have no option but to push their little ones into this hard life in hostile conditions, with no human or labour rights.

There is a lobby which argues that there is nothing wrong with children working if the environment for work is conducive to learning new skills, but studies have shown that the children are made to do boring, repetitive, and tedious jobs and are not taught new skills as they grow older. In these hellholes, like the sweet shops of the old, there is no hope. Children

working in hazardous industries are prone to debilitating diseases which can cripple them for life. By sitting in cramped, damp, and unhygienic spaces, their limbs become deformed for life. Inside matchstick, fireworks and glass industries, they are victims of bronchial diseases and T.B. Their mental and physical development is permanently impaired due to long hours of work. Once trapped they cannot get out of this vicious circle of poverty. They remain uneducated and powerless. Finally in the later years, they too are compelled to send their own children to work. Child labour perpetuates its own nightmare.

If at all the governments were serious about granting children their rights, an intensive effort ought to have been made to implement the directive of the Supreme Court which recommends punitive action against employers of child labour. Only compulsory primary education can eliminate this child labour. If 380 million children are given a better life and elementary education, India's human capital would be greatly enhanced. But that needs, 'a second vision,' as said by former President, Shri. Abdul Kalam.

Based on your understanding of the passage, answer the questions given below:

1. Our government promises to uproot _____.
(a) drug abuse (b) dowry system (c) child abuse (d) child labour
2. Work in hazardous industries is against _____.
(a) moral laws (b) social norms (c) Child Labour Act (d) human resources
3. In India, the number of children going to work instead of school is _____.
(a) 10 million (b) 60 – 100 million (c) 380 million (d) 80,000
4. Industrialists prefer to employ children because they _____.
(a) are the only bread winners (b) need more care (c) demand less wages (d) lack training in skills.
5. The carpet industry employs children because they _____.
(a) have nimble fingers (b) need money for their education (c) like to be financially independent (d) are good designers.
6. The health of child workers suffers because _____.
(a) they are paid meagre wages (b) employers do not give them good food (c) they work under unhealthy conditions (d) they are completely careless.
7. Find words from the passage which mean the same as
(a) dangerous/unsafe (para 1)
(b) helpful (para 3)
8. The Child Labour Act, 1986 states _____.
9. Which two promises have not been fulfilled by the Government yet?
10. A child's childhood is for learning, do not use their childhood for earning. Do you agree? Why?

SECTION B WRITING

Each question carries 10 marks.

11. Develop the hints into a paragraph and give a suitable title.

Internet—transformed society fundamentally—originally US military communication network—1980s—used by academics, government technologists—now, worldwide network—variety of purposes—communication—information—entertainment—used by everyone—reshaped society—altered lifestyle.

(OR)

12. Write two-three paragraphs of around 200 words on any one of the following topics:

- o Fiddling with mobile phones can be hazardous for the small children.
- o Use of technology does not lead to loss of employment.
- o Today's Parents and the Girl Child.

13. What is a business report? Describe the purpose and format of a business report in detail.

(OR)

14. Read the passage given below carefully and answer the questions that follow:

When it comes to drinking water every day, an important question to ask is how much water should you drink? It is a simple question with a not-so-simple answer. Just like one size does not fit all, every individual has different hydration needs which depend on a person's health, level of activity and climatic conditions.

Water is one of the most important nutrients and contributes about 50 – 60% to our body weight. Much also depends on an individual's age, gender, and body-fat content. We can live without food for almost two months, but we cannot survive without water for more than a few days. Water is essential for the body to function normally; dehydration can cause death. Lack of water can lead to malfunctioning of the kidney, which would hinder excretion of uric acid, urea, and calcium, resulting in kidney stones. Its scarcity can affect electrolyte balance in the body, which could be potentially dangerous causing coma or death.

Water is also essential for breathing, as the lungs need to be moist before they exchange oxygen and carbon dioxide. Apart from all those known functions, water is important for chemical reactions in digestion and metabolism. It also helps cool the body through perspiration and lubricates our joints. People suffering from arthritis should drink a glass of water every second hour.

In the last decade, the 8 × 8 guideline (8 ounce or 240 ml of water, or 8 glasses of water) was followed all over the world. The National Institute of Nutrition in its 2011 guidelines prescribed two litres or eight glasses of water per day for a healthy adult.

Optimum hydration can be achieved by drinking low-calorie, nutritious beverages such as lemon water, green tea, coconut water, butter milk, besides plain water. Plan your day in a way that you drink enough liquid. The thumb rule should be to include at least one of these beverages as part of your midday meal. In a nutshell, a person requires a minimum of eight glasses of water per day — do not gulp all in one go, divide the number of glasses equally throughout the day and combine them with low-calorie, nutritious beverages whenever possible.

Regulate your water intake according to weather conditions for staying adequately hydrated.

To conclude, water is the elixir of life. Instead of wasting water, we must adopt rainwater harvesting. Think of states like Rajasthan where water supply is available for a few hours. At some places, there is a great shortage of water. We must use water judiciously and sparingly. What will we leave for the next generation if we use such a precious source carelessly? What we need is to treat even the sea water to meet water scarcity or else we will end up saying, "Water water everywhere, but not a drop to drink."

(A) Based on your understanding of the above passage, make notes on it using headings and subheadings. (B) Use recognisable abbreviations (wherever necessary – minimum four) and supply an appropriate title to it. (C) Write a summary of the above passage in about 100 words.

15. Massive mounds of waste on the premises of a local waste management plant led to a fire break out and toxic smoke cover in many areas of the city. Residents have been advised to remain indoors and use N-95 masks if they step out. Write a letter to the Editor, 'The Times of India,' Kochi urging the authorities to follow the waste management rules and take prompt action into the alleged health hazard caused by the burning of plastic. State reasons why it is imperative and that only managing waste is enough for the health of our citizens. You are Sunil/Sunitha, 4, Lake Road, Kochi. (120 – 150 words)

(OR)

16. The initiative of the Prime Minister of India to turn Gandhi Jayanti into Cleanliness Day was welcomed by one and all. Many celebrities have also become part of this drive. Write a letter to your friend appreciating this drive, emphasising the need to maintain clean surroundings and thereby feel proud of a clean nation. You are Rajesh/Rajni of B-5/147, Swadesh Vihar, Delhi. (120 – 150 words)

SECTION C GRAMMAR

Answer all questions. Each question carries 1 mark.

Fill in the blanks with suitable words.

17. Can you come _____ lunch _____ 2:00pm? (before/after, between/around)
18. Our snacks _____ (taste/tastes) so delicious!
19. I enjoy pizza with sausage and pepperoni. (Identify subject and predicate)
20. Who taught you French? (Change into passive voice)
21. Leo Tolstoy is a famous author. (Identify Proper noun and Common noun)
22. I bought a _____ of bread at the market. (loaf/loaves)
23. Plants grow well in our garden. The sunlight helps their _____.
24. Kate is not well. Kate went to the doctor. (Rewrite the sentence using he/she/it/they)
25. I offered him a chance. He was not interested. (Join the sentences using and/but/or)
26. _____! We won the game. (Add Interjection)

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DEPARTMENT OF COMPUTER SCIENCE
Cochin University of Science and Technology
M.Sc. (Five Year Integrated) in Computer Science (AI & DS)
Make-up Examination, May 2023

21-805-0103: Object Oriented Programming

Time: 3 hours

Maximum Marks: 50

Module I

1. (a) Write a C++ program to compute the value of e^x by using the formula.

$$e^x = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$$

Pass the value of x as command line argument. Use user-defined functions in your program.

(Hint: Use `std::stoi(string.var)` to convert a string to int.)

[6]

- (b) Write a C++ program to print the prime numbers within a given range.

[4]

OR

2. (a) Write a C++ program to demonstrate the use of overloaded constructors.

[5]

- (b) Define the term Abstract Data Types (ADT).

[5]

Module II

3. (a) Write a C++ program to demonstrate the use of virtual base classes.

[5]

- (b) Create a class *Person* and two derived classes *Employee* and *Student*, inherited from class *Person*. Now create a class *Manager* which is derived from two base classes *Employee* and *Student*. Write a C++ program to demonstrate the use of virtual base class. Use constructors in your program to initialize the data members of both derived and base classes.

[5]

OR

4. (a) Write a C++ program which creates a multiple inheritance hierarchy of *Teacher* class derived from *Person* and *Employee* classes. Each class must implement a *show()* member function and utilize scope resolution operator to access the member function using *Teacher* object. Use constructors to initialize data members of both derived and based classes.

[5]

- (b) Discuss about the classification of inheritance with the help of examples.

[5]

Module III

5. (a) Write a C++ program to overload '*' operator using friend function to multiply two MATRIX objects.

[6]

- (b) What are dynamic constructors? How we can dynamically construct a 2-D array member of a class using its constructor?

[4]

OR

P.T.O.

6. (a) With the help of an example program show how constructors with default arguments can be defined. [4]
(b) With the help of an example program show how a class type can be converted to a basic type using casting operator function. [6]

Module IV

7. (a) Suppose you have an inheritance hierarchy with a base class *Animal* and two derived classes *Bird* and *Snake*. Based on the characteristics of animals in general, and birds and snakes specifically, can you think of possible virtual and pure virtual functions to place in *Animal* class. Justify your answer. [4]
(b) Write a C++ program to demonstrate the use of virtual functions in implementing run-time polymorphism. [6]

OR

8. (a) What are abstract base classes? What condition should be met for a class to be abstract? [5]
(b) What do you mean by overriding in C++. Explain with the help of a program. [5]

Module V

9. (a) Define *inline* functions. Explain its significance in class member function definition. [5]
(b) What are namespaces? Explain its significance in C++. [5]

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OR

10. (a) Write a C++ program to demonstrate the use of template classes. [5]
(b) What are run-time exceptions? How it can be handled in C++? Explain with the help of a program. [5]