

Bihar Engineering University, Patna
End Semester Examination - 2022

Course: B.Tech.
 Code: 100304

Semester: III
 Subject: Data Structure & Algorithms

Time: 03 Hours
 Full Marks: 70

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct answer of the following (Any seven question only): **[2 x 7 = 14]**

- (a) In a stack, if a user tries to remove an element from empty stack it is called:
 - ☒ (i) underflow
 - (ii) empty collection
 - (iii) garbage collection
 - (iv) overflow
- (b) Consider the binary max-heap implemented using an array. Which one of the following array represents the heap:
 - (i) 25, 12, 16, 13, 10, 8, 14
 - (ii) 25, 12, 16, 13, 10, 8, 14
 - ☒ (iii) 25, 14, 16, 13, 10, 8, 12
 - (iv) 25, 14, 12, 13, 10, 8, 16
- (c) A hash function h defined as $h(\text{key}) = \text{key} \bmod 7$, with linear probing used to insert keys 44, 45, 79, 55, 91, 18, 63 into a table indexed from 0 to 6. What will be the location of key 18.
 - (i) 3
 - (ii) 4
 - ☒ (iii) 5
 - (iv) 6
- (d) If the number of values to be sorted is already partially sorted, then _____ sorting can be efficient.
 - (i) merge
 - (ii) insertion
 - (iii) bubble
 - (iv) selection
- (e) The time complexity of merge sort is :
 - (i) $O(n)$
 - (ii) $O(\log n)$
 - ☒ (iii) $O(n \log n)$
 - (iv) $O(n^2)$
- (f) State true or false:

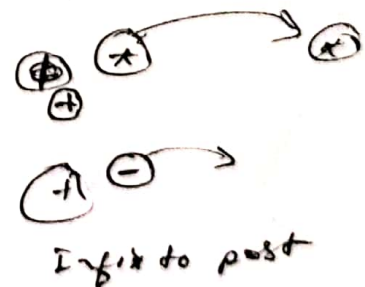
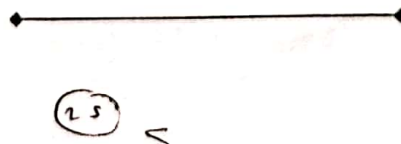
A : Binary search is used for searching in a sorted array.

B : The time complexity of binary search is $O(\log n)$

 - (i) True, False
 - (ii) False, True
 - (iii) False, False
 - ☒ (iv) True, True
- (g) In a circular linked list organization, insertion of a record involves modification of
 - (i) One pointer
 - (ii) Two pointers
 - (iii) More than two pointers
 - (iv) No pointer
- (h) Level order traversal of a rooted tree can be done by starting from the root and performing
 - (i) pre-order traversal
 - (ii) in-order traversal
 - (iii) depth first search
 - ☒ (iv) breadth first search
- (i) An Abstract Data Type (ADT) is
 - (i) same as an abstract class
 - (ii) a data type that cannot be instantiated
 - (iii) a data type for which only the operations defined on it can be used, but none else
 - (iv) all of the above
- (j) How many distinct BSTs can be constructed with 3 distinct keys?
 - (i) 4
 - ☒ (ii) 5
 - (iii) 6
 - (iv) 9

P.T.O.

- Q.2** (a) Explain different asymptotic notations (Big-O, Ω , θ) used for comparing the time complexity of an algorithm with neat figures. [7]
- (b) The run time of an algorithm is represented by the recurrence relation $T(n) = 2T(n/2) + n$; $n \geq 2$ and with boundary condition $T(1) = 0$. What is the time complexity (in terms of θ notation). [7]
- Q.3** (a) Discuss pre-order, in-order and post-order traversal techniques of binary tree. Write a C function for non-recursive pre-order traversal. [7]
- (b) The pre-order traversal sequence of a Binary Search Tree (BST) is 30, 20, 10, 15, 25, 23, 39, 35, 42. Write step by step process to derive the BST and find post-order traversal also. [7]
- Q.4** (a) Consider a circular queue of capacity n -elements implemented with an array. Write C functions for *insertion* and *deletion* operations. [7]
- (b) Convert the given infix expression into postfix using stack : $A + B / C * (D + E) - F$. For each input symbol clearly mention the *action taken* and *status of the stack* during conversion. [7]
- Q.5** (a) Write a C function to delete last node from a singly linked list. [7]
- (b) Create a max-heap by inserting following keys in the given order. Show each insertion step with clear illustration: 25, 35, 18, 9, 46, 70, 48. [7]
- Q.6** (a) Write an algorithm for merge sort and discuss space and time complexity. [7]
- (b) Define collision in hashing. Explain briefly different methodologies to resolve collision. [7]
- Q.7** (a) Write algorithm to count leaf nodes in a binary tree. What is the complexity of your algorithm? [7]
- (b) Compare BFS and DFS traversal techniques for graph. Write an algorithm to perform BFS using queue. [7]
- Q.8** (a) Differentiate between system defined data types and abstract data types with suitable examples. [7]
- (b) What is doubly linked list? What are its applications? Explain how a node can be added as last node using appropriate pseudo code [7]
- Q.9** Write short notes on any two of the following: [7x2=14]
- AVL Rotations
 - Open Addressing & Chaining
 - B-Tree
 - Priority Queue



Bihar Engineering University, Patna
End Semester Examination - 2022

Course: B.Tech.
Code: 100302

Semester: III
Subject: Analogy Electronics Circuits

Time: 03 Hours
Full Marks: 70

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct answer of the following (Any seven question only): **[2 x 7 = 14]**

- (a) For a base current of $10\mu\text{A}$, what is the value of collector current in common emitter if $\beta_{ac} = 100$?
 - (i) $10\mu\text{A}$
 - (ii) $100\mu\text{A}$
 - (iii) 1mA
 - (iv) 10mA
- (b) If an amplifier with gain of -1000 and feedback factor $\beta = -0.1$ had a gain change of 20% due to temperature, the change in gain of the feedback amplifier would be
 - (i) 10%
 - (ii) 5%
 - (iii) 0.2%
 - (iv) 0.01%
- (c) A trivalent impurity has Valence electrons.
 - (i) 4
 - (ii) 5
 - (iii) 6
 - (iv) 3
- (d) Zener diodes are used primarily as
 - (i) Amplifiers
 - (ii) Voltage regulators
 - (iii) Rectifiers
 - (iv) Oscillators
- (e) Peak inverse voltage of diode used in Half-wave rectifier is
 - (i) $2V_m$
 - (ii) $V_m/2$
 - (iii) V_m
 - (iv) $V_m/3$
- (f) For every 10°C increase in temperature, the reverse saturation current of a p-n junction will be increased by:
 - (i) 10 times
 - (ii) 2 times
 - (iii) 4 times
 - (iv) Remain same
- (g) A BJT transistor operates in which region when the base-emitter junction is forward-biased and the base-collector junction is reverse-biased?
 - (i) Active region
 - (ii) Saturation region
 - (iii) Cutoff region
 - (iv) Reverse active region
- (h) In an RC phase shift oscillator, the phase shift provided by each RC stage is :
 - (i) 30°
 - (ii) 45°
 - (iii) 60°
 - (iv) 90°
- (i) If the PIV rating of a diode is exceeded
 - (i) the diode conducts poorly
 - (ii) the diode is destroyed
 - (iii) the diode behaves as Zener diode
 - (iv) None of the above
- (j) For $I_{DDs} = 9\text{ mA}$ and $V_p = -3.5\text{V}$, I_D for $V_{GS} = 0\text{V}$ is
 - (i) 8 mA
 - (ii) 9 mA
 - (iii) 10 mA
 - (iv) 11 mA

Q.2 (a) Define the following:

- (i) Common mode rejection ratio (CMRR)
- (ii) Gain bandwidth product
- (iii) Slew rate of op-amp

[7]

- (b) State the Barkhausen condition for an electronic system to oscillate with feedback. [7]
- Q.3** (a) Derive the expression for stability factor for fix bias circuit with respect to I_{CO} , V_{BE} and β . [7]
- (b) A voltage divider biased circuit has $R_1=39k\Omega$, $R_2=82k\Omega$, $R_C=3.3k\Omega$, $R_E=1k\Omega$ and $CC=18V$. The silicon transistor has used $\beta = 120$. Find Q – point and stability factor. [7]
- Q.4** (a) With the help of block diagram, explain the concept of feedback. [7]
- (b) Discuss with the help of circuit example, the purpose of providing – [7]
- (i) negative feedback;
- (ii) positive feedback in amplifier.
- Q.5** (a) With a neat circuit diagram and waveforms, explain the working of full wave bridge rectifier and show that its ripple factor is 0.48. [7]
- (b) Describe in detail the avalanche and Zener breakdown mechanism in Zener diode. [7]
- Q.6** (a) Derive the expression for output voltage of an instrumentation amplifier. Also write its advantages and disadvantages [8]
- (b) For an N-channel MOSFET the parameters given as $\mu C_{ox} \frac{W}{L} = \frac{0.2mA}{V^2}$, $V_{DS} = 0.2V$, and $V_t = 0.7V$. Find the region of operation and the drain current. [6]
- Q.7** (a) Differentiate between JFET and BJT indicating the advantages and disadvantages. [7]
- (b) What is faithful amplification? Explain the conditions to be fulfilled to achieve faithful amplification in transistor amplifier. [7]
- Q.8** (a) Draw and explain the pin configuration of a 741 Op-Amp. Also explain the internal structure of an Op-Amp with the help of block diagram. [7]
- (b) For the circuit shown below. Assume zener voltage to be 4.78v and voltage drop across the forward biased zener to be 0.7v. Find the peak voltage of output. [7]
- Q.9** (a) State the characteristics of an ideal transformer. [2]
- (b) Define *rms* value, form factor, peak factor, complex power and half power frequency. [5]
- (c) Two two-port network a and b, with open-circuit impedances Z_a and Z_b are connected in series. Drive the Z-parameter equations. [7]



Bihar Engineering University, Patna
End Semester Examination - 2022

Course: B.Tech.
Code: 100314

Semester: III
Subject: Technical Writing

Time: 03 Hours
Full Marks: 70

Instructions:-

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct answer of the following (Any seven question only): **[2 x 7 = 14]**

- (a) Which of the following must be avoided in technical writing?
 - (i) Facts
 - (ii) Grammar
 - (iii) Punctuation
 - (iv) ☒ Personal feelings
- (b) Which of these must be avoided in technical writing?
 - (i) Facts
 - (ii) Grammar
 - (iii) Punctuation
 - (iv) ☒ Personal feelings
- (c) A memo report is
 - (i) External and formal
 - (ii) ☒ Internal and informal
 - (iii) External and informal
 - (iv) Internal and formal
- (d) Which of the following should be avoided in an e-mail?
 - (i) ☒ Wrong e-mail address
 - (ii) Subject line
 - (iii) Smileys
 - (iv) Rereading
- (e) Shortest documents among technical written documents, known as
 - (i) Report
 - (ii) Website
 - (iii) ☒ Summary
 - (iv) Paragraph
- (f) Which of the following is the easiest way of communication?
 - (i) ☒ E-mail
 - (ii) Telephone
 - (iii) Fax
 - (iv) Letter
- (g) We, us and our are example of
 - (i) ☒ Contractions
 - (ii) Pronoun
 - (iii) Name usage
 - (iv) Noun
- (h) Which of the following must be avoided for effective communication?
 - (i) Sharing of activity
 - (ii) Listening
 - (iii) Ambiguity
 - (iv) Politeness
- (i) _____ are the problems arising from expression.
 - (i) Cultural barriers
 - (ii) Semantic problems
 - (iii) Wrong assumptions
 - (iv) Selecting perception
- (j) Kinesics Stands for
 - (i) Space language
 - (ii) Time language
 - (iii) Body language
 - (iv) None of these

Q.2 (a) Write in 250 words on "Role and responsibility of engineers". **[7]**
(b) Write in 250 words on "Why is editing important". **[7]**

Q.3 Differentiate between formal report and informal report. **[14]**

R N - (4)
[7x2=14]

Q.4 (a) Write notes on any two off the following:

- (i) Writing Styles
- (ii) Types of literature review
- (iii) Proof reading
- (iv) Technical Writing

Q.5 What is the difference between report and memo? Explain with examples.

[14]

Q.6 What is the relationship between social responsibility and ethics?

[14]

Q.7 What elements can you use to enhance your presentations?

[14]

Q.8 What are the editing techniques? Explain with examples.

[14]

Q.9 Describe verbal and non-verbal communication in details.

[14]



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- (iv) Question No. 1 is compulsory.

Q.1 Choose the correct answer of the following (Any seven question only): [2 x 7 = 14]

- (a) Which among the following best describes the inheritance?
 - (i) copying the code already written
 - (ii) using the code already written once.
 - (iii) using already defined functions in programming language
 - (iv) using the data and functions into derived segment.
- (b) Which of the following is not a type of class?
 - (i) Abstract class
 - (ii) Final class
 - (iii) Start class
 - (iv) String class
- (c) What is the default access specifier for data members or member functions declared within a class without any specifier in C++?
 - (i) Private
 - (ii) Protected
 - (iii) Public
 - (iv) Depends on compiler
- (d) Which of the following is not the member of class ?
 - (i) Static function
 - (ii) Friend function
 - (iii) Constant function
 - (iv) Virtual function
- (e) Which constructor will be called from the object created in the code below?
Class A
{
 int i;
 A ()
 {
 i= 0;
 }
 A (int x = 0)
 {
 i=x;
 }
};
A obj1;
 - (i) Default constructor
 - (ii) Parameterized constructor
 - (iii) Compile time error
 - (iv) Run-time error
- (f) To prevent any method from overriding, we declare the method as
 - (i) Static
 - (ii) const
 - (iii) final
 - (iv) None of the above
- (g) In C++ dynamic memory allocation is accomplished with the operator:
 - (i) new
 - (ii) this
 - (iii) malloc
 - (iv) delete
- (h) When a class serves as base class for many derived classes, the situation is called
 - (i) polymorphism
 - (ii) hierarchical inheritance
 - (iii) hybrid inheritance
 - (iv) multipath inheritance

- (i) For a method to be an interface between the outside world and a class, it must be declared
 - (i) private (ii) protected
 - (iii) public (iv) external
- (j) Which of the following statement is correct?
 - ✓ (i) Base class pointer cannot point to derived class
 - (ii) Derived class pointer cannot point to base class.
 - (iii) Pointer to derived class cannot be created
 - (iv) Pointer to base class cannot be created.

Q.2 (a) What are the advantages of using exception handling mechanism in a program? Explain the uses of try, throw and catch keywords using example. [7]
 (b) Write a C++ program to find the sum of the series $1+3+5+\dots+n$. [7]

Q.3 (a) What is inheritance? Discuss different types of inheritance with examples. [7]
 (b) What is operator overloading? Write a program in C++ to overload unary minus operator. [7]

Q.4 (a) What is pure virtual function? Write a C++ program that prints 'BEU Patna' from inside a member function of a subclass overriding a pure virtual function. [7]
 (b) Discuss why converting a base-class pointer to a derived-class pointer is considered dangerous by compiler. [7]

Q.5 (a) Differentiate between abstract class and interface with suitable examples. [7]
 (b) What is access modifier in C++? Differentiate between each type. [7]

Q.6 (a) Differentiate between a class and an object. Write an example (syntax) to define a class in C++. [7]
 (b) With an example, explain the terms *constructor* and *destructor*. [7]

Q.7 (a) What is a friend function and what are its advantages? What are the guidelines that should be followed while using friend function? [7]
 (b) Explain dangling pointer with the help of an example. [7]

Q.8 (a) Explain how base class member functions can be involved in a derived class if the derived class also has a member function with the same name. [7]
 (b) Create a class *complex* and implement the following: [7]

- (i) Define suitable constructors and destructors
- (ii) Overload the operators + and -
- (iii) Write a friend function *sum* which adds the real and imaginary parts of a complex object.

Q.9 Write short notes on any two of the following: [7 x 2=14]
 (a) Polymorphism
 (b) Function Templates
 (c) Container class
 (d) Inline function



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Q.1 Choose the correct answer of the following (Any seven question only):

[2 x 7 = 14]

- (a) The value of $\lim_{x \rightarrow 0} \left(\frac{\sin x}{x}\right)^{1/x}$ is
 (i) 0 (ii) 1
 (iii) e (iv) 1/e
- (b) The value of the integral $\int_C \{yzdx + (xz + 1)dy + xydz\}$
 Where C is any path from (1, 0, 0) to (2, 1, 4) is
 (i) 6 (ii) 7
 (iii) 8 (iv) 9
- (c) The maximum value of $\sin x + \cos x$ is
 (i) 1 (ii) 2
 (iii) $\sqrt{2}$ (iv) 0
- (d) The value of $\nabla^2 [(1-x)(1-2x)]$ is equal to
 (i) 2 (ii) 3
 (iii) 4 (iv) 6
- (e) The degree of the differential equation $y \frac{dx}{dy} - \left(\frac{dx}{dy}\right)^2 - \sin y \left(\frac{dx}{dy}\right)^3 - \cos x = 0$ is
 (i) 0 (ii) 1
 (iii) 2 (iv) Cannot be determined
- (f) If $f = \tan^{-1} \frac{y}{x}$, then $\text{div}(\text{grad } f)$ is equal to
 (i) 1 (ii) -1
 (iii) 0 (iv) 2
- (g) If P_n is the Legendre polynomial of first kind, then the value of $\int_{-1}^1 x P_n P'_n dx$ is
 (i) $\frac{2}{(2n+1)}$ (ii) $\frac{2n}{(2n+1)}$
 (iii) $\frac{2}{(2n+3)}$ (iv) $\frac{2n}{(2n+3)}$
- (h) If J_n is the Bessel's function of first kind, then the value of $\int_{-\frac{1}{2}}^{\frac{1}{2}}$ is
 (i) $\sqrt{\frac{2}{\pi x}} \left(\frac{\cos x}{x} - \sin x\right)$ (ii) $\sqrt{\frac{2}{\pi x}} \left(\frac{\sin x}{x} - \cos x\right)$
 (iii) $\sqrt{\frac{2}{\pi x}} \sin x$ (iv) $\sqrt{\frac{2}{\pi x}} \cos x$
- (i) The solution of $p \tan x + q \tan y = \tan z$ is
 (i) $\sin x / \sin y = \varphi(\sin y / \sin z)$ (ii) $\sin x \cdot \sin y = \varphi(\sin y / \sin z)$
 (iii) $\sin x / \sin y = \varphi(\sin y, \sin z)$ (iv) $\sin x / \sin y = \varphi(\sin y \cdot \sin z)$
- (j) The vector $\vec{v} = e^x \sin y \hat{i} + e^x \cos y \hat{j}$ is
 (i) Solenoidal (ii) irrational (iii) rotational (iv) cannot be found

- Q.2 (a) Form the partial differential equation $(x-a)^2 + (y-b)^2 + z^2 = 1$. [7]
 (b) Solve $xp + yq = 3z$ [7]

- Q.3 (a) Find the directional derivative of $\phi = z^2yz + 4xz^2$ at the point $(1, -2, 1)$ in the direction of the vector $2\hat{i} - \hat{j} - 2\hat{k}$. [7]
 (b) Find a unit vector normal to the surface $x^3 + y^3 + 3xyz = 3$ at the point $(1, 2, -1)$ [7]

Q.4 Solve the following questions:-

- (a) Solve partial differential equation $\frac{y^2z}{x}p + xzq = y^2$. [7]
 (b) Show that the function $f(x, y) = \begin{cases} \frac{xy}{\sqrt{x^2+y^2}}, & (x, y) \neq (0, 0) \\ 0, & (x, y) = (0, 0) \end{cases}$ [7]
 is continuous at origin.

- Q.5 (a) If $f = (x^2 + y^2 + z^2)^{-n}$, then find $\text{div grad } f$ and determine n , if $\text{div grad } f = 0$. [7]
 (b) Verify Green's theorem for $\int_C \{(xy + y^2)dx + x^2dy\}$ [7]
 Where C is bounded by $y = x$, $y = x^2$.

- Q.6 (a) Evaluate the integral by changing the order of integration [7]

$$\int_0^{\infty} \int_0^x x e^{-\frac{x^2}{y}} dy dx$$

- (b) Solve the differential equation [7]
 $(x^2 + y^2 + x) dx - (2x^2 + 2y^2 - y) dy = 0$

- Q.7 Verify the Stokes' theorem for [14]
 $A = (y - z + 2)\hat{i} + (yz + 4)\hat{j} - xz\hat{k}$
 Where S is the surface of the cube $x = 0, y = 0, z = 0, x = 2, y = 2$ and $z = 2$ above the xy -plane.

- Q.8 (a) Prove that [6]
 $2nJ_n(x) = x(J_{n-1}(x) + J_{n+1}(x))$
 (b) Prove that [8]

$$\sum_{n=0}^{\infty} \frac{x^{n+1}}{n+1} P_n(1) = \frac{1}{2} \log \left(\frac{1+x}{1-x} \right)$$

Q.9 Solve the following questions:

- (a) Using Green's theorem, evaluate $\int_C [(y - \sin x) dx + \cos x dy]$ where C is the [7]
 plane triangle enclosed by the lines $y = 0, x = \frac{\pi}{2}$ and $y = \frac{2x}{\pi}$
 (b) Prove that $\text{div}(r^n \vec{r}) = (n+3)r^n$. Hence show that $\text{div} \left(\frac{\vec{r}}{r^3} \right)$ is solenoidal. [7]

