



NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

End Semester Examination July - Dec 2024

B. Tech: CSE 1st semester
Course Code: CS14102

Course Name: Programming in C

Max. Marks: 60

Time: 3 Hours

- Write a program to find all unique pairs in an array that sum up to a given number k . [5 M][CO4][BL3]
Example : Input: Array: {1, 4, 6, 2, 3, 8}, k : 7, Output: (1, 6), (4, 3)
- Write a C program that swaps two numbers using pointers. The program should take two integers as input, and then swap their values using a function that accepts pointers as parameters. The function should NOT use any arithmetic operator (+, -, *, /) or third variable. [5 M][CO7][BL3]
- Explain the concept of "pointer to pointer to pointer" in C. Write a C program that demonstrates the use of a pointer to a pointer to a pointer to store and print the value of an integer using all the cases. [1+4 = 5 M][CO7][BL2]
- Write a C program that demonstrates the usage of all types of operators in C. For each operator, explain its function and provide a simple example. [5 M][CO2][BL1]
- Please go through the program below. List out all possible errors and warning. Fix those errors and warning to make the program work properly. Further, write output of the program assuming you provide your roll number to the program as input. [6 M][CO4, CO7][BL3]

```
#include<stdio.h>
int main(){int rollNum;
printf("Enter your roll number"); scanf("%d",&rollNum);
char a[8]; a[8]='\0';
for(int j = 0; j < 7; j++){ *a = rollNum % 10; a++; (*a)++; rollNum = rollNum / 10; }
for(int j = 0; j < 7; j++){printf("\n%d",a[j]);}
}
```

- Guess the output of following programs assuming you input your roll number to the program. [2+2 = 4 M][CO2][BL3]

```
#include<stdio.h>
int main(){
unsigned int rollNum;
printf("Enter your roll number");
scanf("%u",&rollNum);
rollNum += (rollNum/100);
rollNum >>= (rollNum%3);
rollNum <<= (rollNum%3);
printf("%u",rollNum);
}
```

```
#include<stdio.h>
int main(){ int rollNum;
printf("Enter your roll number");
scanf("%d",&rollNum);
rollNum = rollNum - 2*rollNum;
rollNum = rollNum%10;
printf("%d\n",rollNum);
if(rollNum){printf("1\n");}
rollNum=0;
if(rollNum){printf("n2\n");}
rollNum=5;
if(rollNum){printf("3\n");}
}
```

- Write a C program to take input your full name char by char and store it in a one dimensional array. Further, store content of your 1-D array in a 2-D array of size 10x10 evenly. If length of your name is not a perfect square, append 'X' char to make it a perfect square. For example, if the 2-D array is of size 5x5 and your name is **Girish Kumar**, it should look as matrix below. Further make the program print the content of 2-D array in 2-D layout. Usage of any library function apart from printf and scanf is not allowed. [10 M][CO4][BL3]

G	I	R	I		
S	H		K		
U	M	A	R		
X	X	X	X		

OR

Describe the characteristics, scope, lifetime, and default values of the following storage classes. Write a C program to demonstrate the use of each storage class, showing how the value of a variable changes based on its storage class. Explain what a void pointer is and why it is used in C programming. Write a simple program to demonstrate the use of a void pointer to store and print the value of an integer, float and character variable. [3+3+2+2=10 M][CO2, CO4, CO7][BL3]

8. Will the following code snippets compile, if so what will be the output. Explain your answer in all cases. Assume that all necessary header files are already included. You should consider your Roll Number for the input to variable rollNum. [2x10 = 20 M]

a. [CO6][BL3]

```
void function() {
    int x = 5;
    x++;
    printf("%d ", x);
}

int main() {
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int x = 0;
    int y = rollNum%10? rollNum%10:3;
    for (int i = 0; i < y; i++) {
        function();
    }
    return 0;
}
```

B [CO2][BL3]

```
int main()
{
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int y = rollNum%10? rollNum%10:3;
    int x = 5;
    printf("x < 1: %d\n", x < 1);
    printf("y > 1: %d\n", y > 1);
    return 0;
}
```

c. [CO4][BL3]

```
int main() {
    char a[] = {'a', 'b', 'c', '\0', 'd', 'e', '\0'};
    printf("%s", a);
}
```

d. [CO3][BL3]

```
int main()
{
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int y = rollNum%10? rollNum%10:5;
    int sum = 0;
```

```
for (int i = 1; i <= y; i++)
{
    sum += i * i;
}
printf("Sum of squares: %d\n", sum);
return 0;
}
```

e. [CO2][BL3]

```
int main()
{
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int y = rollNum%10? rollNum%10:7;
    int x = 3;
    printf("x == y: %d\n", x == y);
    printf("x < y && y > 5: %d\n", x < y && y > 5);
    printf("x & y: %d\n", x & y);
    return 0;
}
```

f. [CO2][BL3]

```
int main()
{
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int x = 0;
    int b = rollNum%10? rollNum%10:8;
    int a = 5;
    int result = a++ + ++b;
    printf("a = %d, b = %d, result = %d\n", a, b, result);
    return 0;
}
```

g. [CO2][BL3]

```
int main() {
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int a = rollNum%10? rollNum%10:5;
    int b = 10;
    printf("a == b: %d\n", a == b);
    printf("a != b: %d\n", a != b);
    printf("a < b: %d\n", a < b);
    printf("a > b: %d\n", a > b);
    return 0;
}
```

h. [CO2][BL3]

```
int main() {
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int a = rollNum%2? rollNum%2:1;
    int b = 0;
    printf("a && b: %d\n", a && b);
    printf("a || b: %d\n", a || b);
    printf("!a: %d\n", !a);
    return 0;
}
```

i. [CO2][BL3]

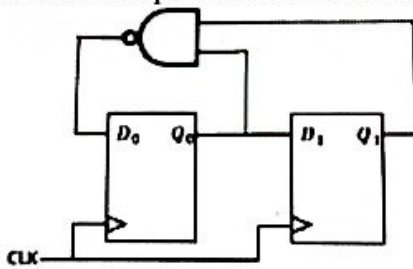
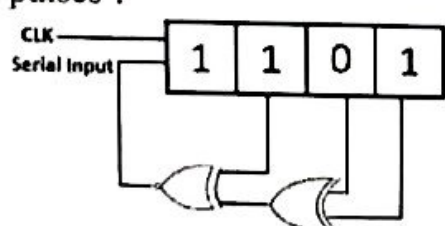
```
int main() {
    unsigned int rollNum;
    printf("Enter your roll number");
    scanf("%u", &rollNum);
    int b = rollNum%10? rollNum%10:3;
    int a = 5;
    printf("a & b: %d\n", a & b); // Bitwise AND
    printf("a | b: %d\n", a | b); // Bitwise OR
    printf("a ^ b: %d\n", a ^ b); // Bitwise XOR
    return 0;
}
```

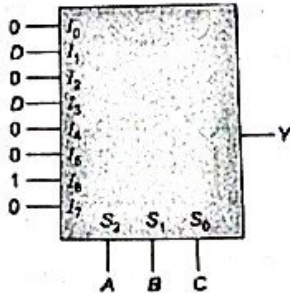
j. [CO3][BL3]

```
int main() {
    int a;
    int result = scanf("%d", &a);
    if (result == 1) {
        printf("Input successful! You entered: %d\n", a);
    } else {
        printf("Input failed.\n");
    }
    return 0;
}
```


Instruction:

1. Attempt all questions.
2. Assume any suitable data, if necessary.
3. The Marks, CO (Course Outcome), and BL (Bloom's Level) related to questions are mentioned right-hand side margin.

		Marks	CO
1.	<p>Answer all the questions (each 2 Marks)</p> <p>a) The two signed numbers represented in 8-bit signed 2's complement form are $P = 00010101$ and $Q = 11101001$. If Q is subtracted from P, the value obtained in signed 2's complement form is _____.</p> <p>b) Write the logic expression for the output of 4-bit magnitude comparator.</p> <p>c) How many gates are required in a full-adder circuit if implemented using universal gates only?</p> <p>d) What is the difference between the latch and flip-flop? What are the types of triggers used in the digital circuits? Explain with examples.</p> <p>e) If f_{in} is the input clock frequency for 4-bit ring counter and 4-bit ripple counter. Then find the ratio of the output frequency of ring counter to ripple counter.</p> <p>f) For the circuit shown, what is the sequence of the counter state (Q_1, Q_0)?</p>  <p>g) What are the four main functions of a computer?</p> <p>h) The Shift register shown in the given figure is initially loaded with the bit pattern 1 1 0 1. Subsequently the shift register is clocked, and with each clock pulse the pattern gets shifted by one bit position to the right. With each shift, the bit at the serial input is pushed to the MSB position. What will be the content stored in the shift register after 7 clock pulses?</p>  <p>i) A 6-bit binary ripple-down counter with MOD-64 is holding the count 110111. What will be the count after 50 clock pulses?</p> <p>j) What are the differences between combinational circuits and sequential circuits?</p>	20	CO1 CO2 CO3 CO4 CO5
2.	<p>Explain the operation of the JK flip flop with logic diagram, truth table, characteristic table, excitation table, and state diagram.</p>	7.5	CO3 CO4

3.	Design a sequence generator for a sequence 110101. Or Design a counter for the following sequence generator $0 \rightarrow 12 \rightarrow 10 \rightarrow 6 \rightarrow 9 \rightarrow 2 \rightarrow 7 \rightarrow 14 \rightarrow 5 \rightarrow 8 \rightarrow 0$	
4.	Design the logic circuit to perform the following operation. (a) $A + B$ (b) $B - A$ Or Design a sequential circuit for a MOD-10 synchronous counter. Perform the operation using state table. Draw the state diagram perform the operation using T-flip-flop.	5
5.	What is priority encoder? Design the 8×4 priority encoder with a valid output. Or Explain 8×1 multiplexer with the logic diagram and truth table. What is the logic function of output Y for the following 8×1 multiplexer? 	5
6.	What, in general terms, is the distinction between computer organization and computer architecture? List and briefly define the main structural components of a computer. Or Design a MOD-12 ripple-down counter and show the timing waveform with output at each clock pulse. If the input clock frequency is 600 kHz then find the frequency of the output waveform. Assume all flip flops are negative edge triggered with 0 output initially.	5
7.	What is the difference between DRAM and SRAM in terms of applications and characteristics such as speed, size, and cost? OR What do you mean by the overriding input signals? What are their types? Explain the working and operation of Johnson counter. What are the differences between the ring and Johnson counter?	5
8.	What are the differences among direct mapping, associative mapping, and set-associative mapping? Or Explain the operation of the SR flip-flop with logic diagram, truth table, characteristic table, excitation table, and state diagram.	5

National Institute of Technology Patna

Department of Mathematics

End Semester Examination : December, 2024

Course Name: Engineering Mathematics – I

Program: B.Tech.(CSE-II)

Duration: 3 Hrs

Course Code: MA141012

Full Marks: 60

Answer All The Questions

1. (a) Find the inverse of the matrix A given below using row reduction.

$$A = \begin{pmatrix} 1 & 2 & 1 \\ 2 & 1 & -1 \\ 1 & 5 & 4 \end{pmatrix}.$$

[6M]

- (b) Define the algebraic multiplicity and geometric multiplicity of an eigenvalue of a square matrix. Hence check

if the matrix $B = \begin{pmatrix} 4 & 0 & 1 \\ 2 & 3 & 2 \\ 1 & 0 & 4 \end{pmatrix}$ is diagonalizable.

[6M]

- (c) Let $T: \mathbb{R}^4 \rightarrow \mathbb{R}^3$, be a linear mapping, defined by $TX = AX$, where $A = \begin{bmatrix} 1 & 2 & 0 & 1 \\ 2 & -1 & 2 & -1 \\ 1 & -3 & 2 & -2 \end{bmatrix}$ and $X \in \mathbb{R}^4$.

Find the basis and dimension of the kernel and range of T .

[6M]

- (d) Using the Euclidean inner product and by using the Gram-Schmidt process, transform the given basis $\{u_1 = (1, 0, 1), u_2 = (-1, 1, 0), u_3 = (0, 2, 1)\}$ of \mathbb{R}^3 into an orthonormal basis.

[6M]

- (e) Find the system of linear equations whose solution space is spanned by the vectors $u = (1, 2, 3, -1, 2)$ and $v = (2, 4, 7, 2, -1)$.

[6M]

2. (a) Find the general solutions of the following ODEs'.

(i) $(x^3 - 3xy^2)dx - (y^3 - 3x^2y)dy = 0$

(ii) $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^x \sec y$

[3M]

[3M]

- (b) Solve the following differential equation using operator method,

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$$

- (c) Use variation of parameters method to solve

$$(D^2 + 4)y = 8 \sin 2x.$$

[6M]

[6M]

3. (a) Test the convergence for all values of $x > 0$ for the infinite series,

(i) $\frac{1}{3}x + \frac{1.2}{3.5}x^2 + \frac{1.2.3}{3.5.7}x^3 + \dots$

[3M]

(ii) $\sum_{n=1}^{\infty} \frac{1}{n!}$

[3M]

- (b) Assume that among all rectangular boxes with fixed surface area of 20 square meters, there is a box of largest possible volume. Find its dimensions.

[6M]

*****ALL THE BEST*****



NATIONAL INSTITUTE OF TECHNOLOGY, PATNA
END-SEMESTER EXAMINATION, JUL - DEC 2024

Program: B.Tech; Semester: 1st
Course Code: CH14101
Full Marks: 60

Batch: CSE – II

Department: CSE
Course Name: Engineering Chemistry
Duration of Examination: 3 hours

All questions are compulsory & in accordance to NEP 2020

Q1	a) Define higher calorific value and lower calorific value in the context of solid fuel. Calculate the gross and net calorific value of coal having the following compositions: Carbon – 85%, Hydrogen – 8%, Sulphur – 1%, Nitrogen – 2%, Ash – 4%. Latent heat of steam – 587 cal/g	04	CO1
	b) What is cracking in fuels and why is it required? What are the two methods of cracking? List the two methods for synthesis of gasoline.	04	CO1
	c) What are primary and secondary standard solutions? Name the primary and secondary standard solutions employed for the estimation of Cu(II) in an unknown solution. What is the difference between iodometry and iodimetric titrations?	04	CO2
	d) Name the oxidant employed for estimation of Fe(II) in Mohr's salt in presence of 1M acid solution. What is the color change at the equivalence point? Write the Nernst expression for each half-cell. Derive the expression for E _{cell} at the equivalence point.	04	CO2
	e) Draw the geometry for metal chelate complex in the complexometric titration of hard metal ions for estimation of hardness of water. The pH range of 8-10 is ideal for the stability of the hard metal chelate complex. Why lower or higher pH values are detrimental for the stability of this complex? Name the chemical species responsible for permanent and temporary hardness?	04	CO3
	f) Discuss the factors contributing to repulsive electron pairing energy in the context for electronic configuration of the transition metals.	04	CO3
Q2	a) What is a fuel cell? Draw a proton-exchange membrane fuel cell. Explain its working using chemical reactions. List all the features of proton-exchange membrane.	06	CO1
	b) (i) What is a formal potential? For the half-cell reaction provided below, calculate the formal potential at pH = 7. (E ⁰ = 0.731 V) $\text{C}_2\text{H}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e} \rightleftharpoons \text{C}_2\text{H}_4(\text{g})$	06	CO2

(ii) The half-cell reaction for the cathode in the cell



Write the anodic half-cell reaction and complete cell reaction. Evaluate E_{cell} .

Given $E^0_{\text{Cd (red)}} = -0.402 \text{ V}$.

c) Comment on the bond order and magnetic character of He_2 and O_2 using pictorial representation of molecular orbital energy level diagrams in each case.

06

CO3

d) What are the essential requirements for linear combination of atomic orbitals. Invoking the same, illustrate the different types of molecular orbital formation from atomic orbitals.

06

CO3

e) Predict and explain the structure of the following coordination compounds using VBT: -

06

CO3

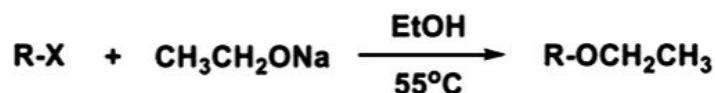
(i) PtCl_4^{2-} ; (ii) NiCl_4^{2-} ; (iii) $\text{Co}(\text{NH}_3)^{6+}$

f) Explain the rate of reactions in following cases, as per mechanism assigned: -

06

CO4

(i) S_N^2



Relative
Rate

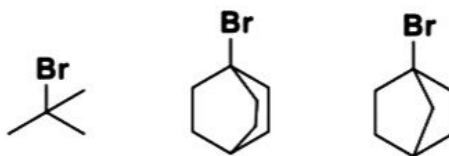
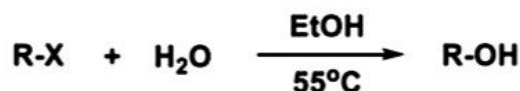
1.0

2.8×10^{-1}

3.0×10^{-2}

4.2×10^{-6}

(ii) S_N^1



Relative
Rate

1.0

1.0×10^{-6}

1.0×10^{-14}



NATIONAL INSTITUTE OF TECHNOLOGY PATNA
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
END SEMESTER EXAMINATION, JULY – DEC 2024

BTech: 1st Semester (Section I, II, III)

Course Name: Information Technology Workshop

Maximum Time: 3 hours

Course Code: CS14106
Maximum Marks: 60

Instructions:

1. Attempt all questions & sub questions must be answered sequentially at one place.
2. Assume any suitable data, if necessary.
3. The marks, Course Outcome (CO) and Bloom's Level (BL) related to questions are mentioned on the right-hand side margin.

Question		Marks	CO	BL
1	a. Name and describe in brief the basic elements that make up a computer system. b. Explain the role of a Loader in a computer system. How does the loader load an executable program into memory, and what is the significance of address binding in this process?	5+5	CO1	1, 2
2	a. Explain in brief the function of the Control Unit (CU). How does the CU decode the instruction from memory and send control signals to direct the ALU, registers, and other components? b. Explain the characteristics and limitations of Dynamic RAM (DRAM) and Static RAM (SRAM). How do these two types of RAM differ in terms of speed, volatility, and power consumption?	5+5	CO2, 3	2
3	a. Define CPU registers, how do registers contribute to the overall performance and speed of the processor compared to other types of memory? b. Give the steps to Convert Text to a Table in Microsoft Word. c. Differentiate between a formula and a function as used in Microsoft Excel.	5+3+2	CO3, 4	1, 6
4	a. How do the various data transmission modes—namely simplex, half-duplex, and full-duplex—differ in terms of their communication flow, speed, bandwidth utilization, and practical applications, and what are the advantages and limitations of each mode in different types of network environments? b. Define LAN, MAN, and WAN, and describe the key differences in their scope, geographical coverage, data transmission rates, and typical applications.	5+5	CO5	1, 2
5	a. Explain in brief Ring Topology, Bus Topology, and Star Topology, including how data is transmitted, the role of devices in the topology, and the setup and layout of each. b. Explain in brief the different types of VPN. What are the benefits of a VPN connection?	5+5	CO5	2
6	a. How do various types of malicious software, such as viruses, worms, ransomware, spyware, and Trojans, differ in their mechanisms of infection, spread, and damage? b. Explain in brief Hacking and Firewall.	5+5	CO6	2

Wish you all the best