

Tutorial Problems

1. If cost price and selling price of an item are input through the keyboard, write a program to determine whether the seller has made profit or incurred loss. Also determine how much profit he made or loss he incurred.
2. If it was Monday on 01st Jan 2001, write a C program to determine the day for the given date in ddmmyyyy format.
3. Write a C program to solve the quadratic equation $ax^2+bx+c=0$. The input to the program will be the coefficients (a, b and c), and output will be the roots of the quadratic polynomial.
4. Using C program identify (i) whether the character entered through the keyboard is uppercase or lowercase and (ii) Whether the character entered through the keyboard is a special symbol or not.
5. Write a C program to identify a input number is a palindrome or not.
6. Given three points (x1,y1), (x2,y2) and (x3,y3) write a program to check if all the three points fall on one straight line.
7. Given the coordinates (x,y) of center of circle and its radius, write a program that will determine whether a point lies inside the circle.
8. Evaluate the following expressions:
 - a. $\text{Result} = 5 * b * b * x - 3 * a * y * y - 8 * b * b * x + 10 * a * y;$
(assume $a = 3, b = 2, x = 5, y = 4$)
 - b. $\text{Result} = 10/5/2/1;$
 - c. $\text{Result} = 2 - 3 + 5 * 2 / 8 \% 3;$
 - d. $y = z = -3 \% -8 / 2 + 7;$
 - e. $a = b = c = 3 + 4;$

Assignment Problems

- (1) Write a C program that evaluates the following arithmetic expressions and then prints out the result.

$$(a) X = 1.234 \times 10^5 + 7.5 \times 10^{-3}$$

$$(b) Y = 19.2 \sin 25 + (5.6 + 12 / 7.2) \times 10^5$$

- (2) Write a C program to round of a floating point number to the nearest integer. (Hint: Add 0.5 to the number and truncate it to an integer.)
- (3) Use this knowledge to round of a floating point number to the nearest tenth and hundredth decimal points.
- (4) Write a C program that reads n ($n \geq 10$) number of positive integers from the key board and finds the largest among them. Read

n from keyboard. (Don't use array) Is there any restriction on printing the input and output of this program?

(5) Write a C program that reads marks (out of 100) that a student got in PDS. The grade calculated as follows

- MARKS > 90 -> Ex
- 89 >= MARKS >= 80 -> A
- 79 >= MARKS >= 70 -> B
- 69 >= MARKS >= 60 -> C
- 59 >= MARKS >= 50 -> D
- 49 >= MARKS >= 35 -> P
- 34 >= MARKS -> F

Print the marks and the grade that the student got in PDS

(6) Write a C program that reads x-y coordinates of three points A(x1; y1), B(x2; y2) and C(x3; y3). (i) Check whether they forms a triangle or not. (ii) Check whether the triangle isosceles / equilateral / scalene (iii) Check whether the triangle is right angled
Print the inputs and outputs

(7) Write C code to compute the sum of squares of first n natural numbers. $SUM = 1^2 + 2^2 + 3^2 + \dots + N^2$

(8) Write C code which reads a floating point number x and an integer n from keyboard and computes the following sum: $x + (x+1) + (x+2) + (x+3) + \dots + (x+n)$. Print the value of x and Sum.

(9) Write C code which reads an integer number x and an integer n from keyboard and computes the following: $x * (x+1) * (x+2) * (x+3) * \dots * (x+n)$. Run the program by increasing the value of n in steps of 10 with the starting value as n = 2. Assume x = 10. Observe the results and justify.

(10) Write C code to compute the following sum: $SUM = 1.2 + 2.3 + 3.4 + \dots$ upto n terms. Print n and SUM. Write a C program that reads two positive real numbers. Now, enter an operator from the keyboard and perform the operation. The operator can be any of the following: + (addition), - (subtraction), * (multiplication), / (division) and % (remainder) Print the output as follows: (i) $134.78 + 256.09 = 390.87$ and (ii) $150 \% 18 = 6$ etc.

- (11) Write a C program to compute the following sum:
 $1+2^2+3^3+4^2+5+6^3+7+8^2+9^3+10^2+11+12^3+13+14^2+ \dots$
- (12) Write a C program to verify the divisibility of a given number with the digits from 1-10.
- (13) Write a C program to test whether the given number is divisible by 11?
- (14) Write a C program to find all possible factors of a given number.
- (15) Write a C program to find the perpendicular bisector of the line.

PDS LAB – 2 (Section-5) Date: 16-January 2017.

Tutorial Problems

1. Write a C program to round of a floating point number to the nearest integer.
2. Write a C program to enter your name and print the same.
3. Using C program identify (i) whether the character entered through the keyboard is uppercase or lowercase and (ii) Whether the character entered through the keyboard is a special symbol or not.
4. Given three points (x1,y1), (x2,y2) and (x3,y3) write a program to check if all the three points fall on one straight line.
5. Convert the decimal number 472 to hexadecimal and binary numbers.
6. Given the coordinates (x,y) of center of circle and its radius, write a program that will determine whether a point lies inside the circle.
7. Evaluate the following expressions:
 - a. $\text{Result} = 5 * b * b * x - 3 * a * y * y - 8 * b * b * x + 10 * a * y$; (assume $a = 3, b = 2, x = 5, y = 4$)
 - b. $\text{Result} = 10/5/2/1$;
 - c. $\text{Result} = 2 - 3 + 5 * 2 / 8 \% 3$;
 - d. $y = z = -3 \% -8 / 2 + 7$;
 - e. $a = b = c = 3 + 4$;

Assignment Problems

- 1) Write a C program to round of a floating point number to the nearest 1st and 2nd digits after a decimal point. (Ex: 10.32 -> 10.3, 10.327 ->10.33)
- 2) Write a C program to solve the quadratic equation $ax^2+bx+c=0$. The input to the program will be the coefficients (a, b and c), and output will be the roots of the quadratic polynomial.
- 3) Write C program to determine the day of the given date. Consider the reference as today's date (16 January 2017) and day (Monday). Assume that the user provide the date through keyboard as 8-digit number in "ddmmyyyy" format. The program has to print the given date and the corresponding day in the following format: Day of **16 January 2017** is **Monday**. The program should compute the day for both future and past dates.
- 4) Write a C program that reads x-y coordinates of three points A(x1; y1), B(x2; y2) and C(x3; y3). Check (i) whether they forms a triangle or not? (ii) whether the triangle is isosceles / equilateral / scalene? and (iii) whether the triangle is right angled? Print the inputs and outputs.
- 5) Write a C program to determine the equation of a perpendicular bi-sector (PBS) for the straight line AB. Assume that AB is not a horizontal line (y coordinates of A and B are not same). The program accepts the (x,y) coordinates of A and B, and it print the length of the line AB, slope of the line AB, mid-point of AB, slope of the PBS and equation of PBS.

PDS LAB – 3 (Section-5) Date: 23rd January 2017.

Tutorial Problems

1. Write a C program to read a sequence of characters (terminated by new line character '\n') and count the number of vowels entered through keyboard.
2. Write a C program to find the sum of the squares of first N natural numbers. Accept the value of N from the user through key board.
3. Write C code which reads a floating point number 'x' and an integer 'n' from keyboard and computes the following: $x + (x+1) + (x+2) + (x+3) + \dots + (x+n)$. Print the value of x and Sum.
4. Write a C program to determine the number of positive and negative numbers entered through keyboard. The key-board entry will be terminated by 0.
5. Read any 4 digit number and print the sum of its digits.

Assignment Problems

- 1) Write a C program to find the sum of the first N terms of the following series:
 $1 - 2 + 3 - 4 + 5 \dots$
- 2) Write C code which reads an integer number x and an integer n from keyboard and computes the following: $x*(x+1)*(x+2)*(x+3)* \dots * (x+n)$. Run the program by increasing the value of 'n' in steps of 5 with the starting value as n = 2. Assume x = 10. Observe the results and justify.
- 3) Write a C program that reads two positive real numbers. Now, enter an operator from the keyboard and perform the operation. The operator can be any of the following:
 - + (addition)
 - (subtraction)
 - * (multiplication)
 - / (division) and
 - % (remainder)

If the operator is not the valid one, print the same message. Otherwise print the expression as follows: num1 OP num2 = result (ex: $x + y = z$, $x - y = z$,).

- 4) Write a C program to test whether the given number (consider a max of 999999) is divisible by 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11. (use the first principles of division)

Divisibility by	Rule
2	Last digit (digit in one's place) should be even number
3	Sum of all digits of the number to be divisible by 3
4	The number formed by last 2 digits (one's and ten's place) should be

	divisible by 4
5	Last digit (digit in one's place) of the number should be either 0 or 5.
6	The number should be divisible by both 2 and 3
7	Double the last digit and subtract it from the remaining leading truncated number. If the result is divisible by 7, then so was the original number. Apply this rule over and over again as necessary.
8	If hundred's place is even check whether the number formed by last 2 digits is divisible by 4. If hundred's place is odd, add 4 to the number formed by last 2 digits and check whether it is divisible by 4.
9	Sum of all digits of the number to be divisible by 9
10	Last digit should be zero
11	Difference of sum of even and sum of odd digits should be divisible by 11.

PDS LAB – 4 (Section-5) Date: 30th January 2017; Arrays and Strings

Tutorial Problems

1. Write a C program to read a sequence of numbers from a key board (terminated by some user defined constraint such as entry of some specific number) and compute (i) the average of the sequence, (ii) number of entered values greater than, less than and equal to the average of the sequence.

2. Write a C program to enter your name and print the unique characters. Modify your code for both case sensitive and insensitive.

Example:

Input: K Sreenivasa Rao

Output: K S r e n i v a s R o (case sensitive); K S r e n i v a s o (case insensitive)

3. Write a C program to accept input as number of rows, and print the output in the following pattern (Ex: output pattern for 6 rows).

```

      1
    1 1
  1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1
```

Assignment Problems (For All Students)

1. Write a C program that reads an array A[] of 'N' integers and a separate integer 'X' from keyboard. Now check whether the X is an element of the array A or not. If X is an element of array 'A' then print 'X' and the position of 'X' in the array.

2. Write a C program to read 'N' real numbers from the user to find the standard

deviation of the series of numbers. $\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \mu)^2}$

3. Write a C program to find all possible sub-arrays whose sum equal to zero.

Example:

Input: {4, 2, -3, 1, 6, -2, -1, -1, -2, 5, -2}

Output: Number of possible sub-arrays = 5.

S1: {2,-3,1};

S2: {2,-3,1,6,-2,-1,-1,-2};

S3: {-3,1,6,-2,-1,-1};

S4: {6,-2,-1,-1,-2};

S5: {-1,-2,5,-2}

4. Write a C program to read a string of characters and print it in reverse order. Print the input string also.

Example:

Input: Programming and Data Structure

Output: erutcurtS ataD dna gnimmargorP

5. Write a C program to accept input as number of rows, and print the output in the following pattern (Ex: output pattern for 5 rows).

```
1
123
12345
123
1
```

Additional Assignment Problems (For Students who completed 5 problems)

1. Write a C program that reads an array A[] of N integers and prints the Kth largest element of the array. Do not sort the whole array

Example:

Input Array : 21, 5, 54, 29, 6, 1, 76, 23, 7, 2

Input: k = 3

Output: The 3rd largest element of the array is 29

2. Write a C program that accepts text from keyboard and print the total number of words, number of unique words and their frequencies.

Input: IIT Kharagpur IIT Mumbai IIT Hyderabad IISC Bangalore IITG IIM Alhabad IIM Bangalore IIT Ganghinagar

Output:

Total Number of words = 15

Number of Unique words = 10

Frequency of Occerrence: IIT – 4; Kharagpur – 1; Mumbai – 1; Hyderabad – 1; IISC – 1; Bangalore – 2; IITG – 1; IIM – 2; Alhabad – 1; Ganghinagar – 1;

PDS LAB – 5 (Section-5) Date: 6th February 2017;

Arrays, Strings & Functions

Tutorial Problems

1. Write C functions to (i) find the length of the string and (ii) reverse the string. Through main () function enter the string using key board and demonstrate the above functions.
2. Write a C function to determine $\sin(x)$ using the following expression $(x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots)$. Through main () function provide the value of x in 'degrees' and number of terms to be considered for computation. Demonstrate the C function by calling through main program.
3. Write C functions to find (i) sum of two matrices and (ii) transpose of a matrix. Through main () function enter two matrices and demonstrate the above written functions.

Assignment Problems (For All Students)

1. Write C functions to compute (i) square of a number and (ii) average of the given array of numbers. Through main () function, enter the array of numbers and use the above C functions while computing the variance and standard deviation of the entered sequence of numbers.
2. Write C functions to (i) reverse the string and (ii) comparison of 2 strings. Through main () function enter the strings and demonstrate the above functions. Also, evaluate whether the given string is palindrome or not, by using the above functions.
3. Write a C function to determine $\cos(x)$ using the following expression $(1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots)$. Through main () function provide the value of x in 'degrees' and termination the evaluation when the difference between successive computations is below 0.00001. Demonstrate the C function by calling through main program.
4. Write a C function to sort the array of numbers using Bubble Sort. Through main () function, enter the array and number of elements and call the above developed function to sort the given array.
5. Write a C program to determine the LCM of 2 given numbers. Use co-prime function to verify the 2 number or co-prime or not. Procedure to compute LCM is successively divide the 2 numbers by a common divisor till the numbers become co-prime. At that point multiply all common divisors and left-over numbers.

Example:

Input: $n_1 = 24$, $n_2 = 40$; (Co-prime: No)

Divide by 2: 12 and 20 (Co-prime: No)

Divide by 2: 6 and 10 (Co-prime: No)

Divide by 2: 3 and 5 (Co-prime: Yes)

LCM = $2 \times 2 \times 2 \times 3 \times 5 = 120$.

Assignment Problems (For those who completed 5 assignment problems)

1. Write a C function to search an element in a sorted array using binary search approach. Through main () function, enter the array and use first Bubble Sort function to sort the array, then demonstrate the binary search function to search the given element.

Example:

Input: 4 3 2 5 7 6 8 1 9 and element to search = 2

Step-1: Sorted array: 1 2 3 4 5 6 7 8 9

Step-2: Binary search

Check the 'element to search' with 'middle element' and consider the partition to search repeatedly.

2. Write C functions to retrieve (i) the name of the state given the city name and (ii) the names of the cities given the name of the state. Through main () function enter the names of the states and their respective cities and call the above functions to demonstrate the retrieval process.

State	City			
Andhra Pradesh	Vijayawada	Guntur	Vizag	Tirupati
Tamil Nadu	Chennai	Madurai	Coimbatore	Tiruchi
Karnataka	Bangalore	Mysore	Beedar	Mangalore
Uttar Pradesh	Kanpur	Luknow	Allahabad	Banaras

3. Write a C program to display the elements of a matrix by traversing the path such that the sum of row and column indices increases incrementally.

Input:

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Output-1:

1
2, 5
9, 6, 3
4, 7, 10, 13
14, 11, 8
12, 15
16

Output-2:

1
5, 2
9, 6, 3
13, 10, 7, 4
14, 11, 8
15, 12
16

PDS LAB – 5 (Section-5) Date: 6th February 2017;

Arrays, Strings & Functions

Tutorial Problems

1. Write C functions to (i) find the length of the string and (ii) reverse the string. Through main () function enter the string using key board and demonstrate the above functions.
2. Write a C function to determine $\sin(x)$ using the following expression $(x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots)$. Through main () function provide the value of x in 'degrees' and number of terms to be considered for computation. Demonstrate the C function by calling through main program.
3. Write C functions to find (i) sum of two matrices and (ii) transpose of a matrix. Through main () function enter two matrices and demonstrate the above written functions.

Assignment Problems (For All Students)

1. Write C functions to compute (i) square of a number and (ii) average of the given array of numbers. Through main () function, enter the array of numbers and use the above C functions while computing the variance and standard deviation of the entered sequence of numbers.
2. Write C functions to (i) reverse the string and (ii) comparison of 2 strings. Through main () function enter the strings and demonstrate the above functions. Also, evaluate whether the given string is palindrome or not, by using the above functions.
3. Write a C function to determine $\cos(x)$ using the following expression $(1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots)$. Through main () function provide the value of x in 'degrees' and termination the evaluation when the difference between successive computations is below 0.00001. Demonstrate the C function by calling through main program.
4. Write a C function to sort the array of numbers using Bubble Sort. Through main () function, enter the array and number of elements and call the above developed function to sort the given array.
5. Write a C program to determine the LCM of 2 given numbers. Use co-prime function to verify the 2 number or co-prime or not. Procedure to compute LCM is successively divide the 2 numbers by a common divisor till the numbers become co-prime. At that point multiply all common divisors and left-over numbers.

Example:

Input: $n_1 = 24$, $n_2 = 40$; (Co-prime: No)

Divide by 2: 12 and 20 (Co-prime: No)

Divide by 2: 6 and 10 (Co-prime: No)

Divide by 2: 3 and 5 (Co-prime: Yes)

LCM = $2 \times 2 \times 2 \times 3 \times 5 = 120$.

Assignment Problems (For those who completed 5 assignment problems)

1. Write a C function to search an element in a sorted array using binary search approach. Through main () function, enter the array and use first Bubble Sort function to sort the array, then demonstrate the binary search function to search the given element.

Example:

Input: 4 3 2 5 7 6 8 1 9 and element to search = 2

Step-1: Sorted array: 1 2 3 4 5 6 7 8 9

Step-2: Binary search

Check the 'element to search' with 'middle element' and consider the partition to search repeatedly.

2. Write C functions to retrieve (i) the name of the state given the city name and (ii) the names of the cities given the name of the state. Through main () function enter the names of the states and their respective cities and call the above functions to demonstrate the retrieval process.

State	City			
Andhra Pradesh	Vijayawada	Guntur	Vizag	Tirupati
Tamil Nadu	Chennai	Madurai	Coimbatore	Tiruchi
Karnataka	Bangalore	Mysore	Beedar	Mangalore
Uttar Pradesh	Kanpur	Luknow	Allahabad	Banaras

3. Write a C program to display the elements of a matrix by traversing the path such that the sum of row and column indices increases incrementally.

Input:

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

Output-1:

1
2, 5
9, 6, 3
4, 7, 10, 13
14, 11, 8
12, 15
16

Output-2:

1
5, 2
9, 6, 3
13, 10, 7, 4
14, 11, 8
15, 12
16

PDS LAB – 6 (Section-5) Date: 6th March 2017;

Recursion & Pointers

Tutorial Problems

1. Write a C program to check whether the given pair of numbers are co-prime or not. (Hint: Pair of numbers are said to be co-prime if their GCD (Greatest Common Divisor) is equal to one.) Write a C function to compute GCD using recursive calls, and use the GCD function in the main program to check the co-prime property.
2. Write a C function (using recursive calls) to compute the sum of N natural numbers. Through main () function enter the value of N and print the sum by calling the above function.
3. Write a C function to find the sum of the elements of an array by passing the pointer of the array as argument and return the sum to a main () function. Using main () function enter the length of the array and call the above function and print the returned sum value in the main program.

Assignment Problems (For All Students)

1. Expression to evaluate binomial coefficient is as follows:

$$\binom{n}{r} = \begin{cases} 1, & \text{if } r = 0 \\ 1, & \text{if } n = r \\ \binom{n-1}{r} + \binom{n-1}{r-1} & \text{Otherwise} \end{cases}$$

Write a C function to compute binomial coefficient using recursive calls. Through main function evaluate $\binom{n}{r}$ by inputting the values of n and r through key board. Also analyse the number of calls to evaluate $\binom{n}{r}$ and repetitions.

2. Write a C function to recursively compute the sum of digits of a positive integer. Demonstrate its applicability through main () function.
3. Write a C function to compute x^n using recursive calls. Demonstrate its applicability through main () function.
4. Write a C function to determine $\cos(x)$ using the following expression $\left(1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots\right)$. In this problem you are required to use recursive calls of cos function, factorial function and power function. Through main () function provide the value of x in 'degrees' and number of terms to be considered for computation. Demonstrate the C function by calling through main program.
5. Write a C function to sort the array using recursive calls. Using main () enter the size and elements of an array and print the array before and after sorting.

PDS LAB – 7 (Section-5) Date: 20th March 2017;
Pointers & Dynamic Memory Allocation
Tutorial Problems

1. Write a C function *int* factor_compute (int*)* to return all factors of a given positive integer in increasing order. Use pointers for passing the arguments and return the result. Demonstrate the utility of the above C function using main () function. Input the positive number through key board and print the number and its factors as output. Use malloc () and free () functions to allocate and release the memory.
2. Using pointers write C functions to (i) *char* enter-text (char*)* enter input text terminated by enter key and return the entered text through a pointer and (ii) *int string_lenght (*char)* to determine the length of the string and return it to the main function. Through main () function, call the above 2 functions and print the input string and its length.
3. Write a C program (using pointers) to count the number of positive, negative and zero values in an $M \times N$ matrix. Use appropriate dynamic memory allocation functions to allocate the memory. Enter the values of M (rows), N (columns) and elements of the matrix through key-board, and print the elements of a matrix row-column form and mention the number of positive, negative and zero values present in the matrix.

Assignment Problems (For All Students)

1. Write a C function (using pointers) to compute and return the common factors for the given sequence of numbers. Use the solution of Tut-1 question to solve this problem.
2. Write a C function (using pointers) to reverse the input string and then check whether the given string is palindrome or not? Use the solution of Tut-2 question for solving this question.
3. Write C functions to compute (i) addition of 2 matrices and (ii) product of 2 matrices using pointers. Through main (), input the 2 matrices using keyboard and print their sum and product.
4. Write a C function (using pointers) to merge the 2 sorted arrays into a single sorted array and return the sorted array to the main function. Input 2 sorted arrays from keyboard through main function and print the returned merged array.
5. Solve the above problem using recursive calls and pointer manipulation.

Assignment Problems (For those who completed 5 assignment problems)

1. Write C functions to (i) Enter the list of names (use the solution of Tut-2 question) and (ii) sort them based on alphabetical order. Through main () specify the number of names in the list, and call the above functions to enter the list of names and for sorting. Print both the input list of names and sorted list of names.
2. Write a C function to compute the determinant of a given matrix. Use pointers and appropriate memory allocation functions to solve the above problem.

PDS LAB – 8 (Section-5) Date: 27th March 2017

Structures & Linked Lists

Tutorial Problems

1. Write a C program to input a student record which contains the following details: {int roll, char name[20], int age}. Define the structure to represent the details of the student, input the attributes of the student record through keyboard and print the same.
2. Modify the above program to enter and print multiple student records say “n” taken from the keyboard. First try with arrays and later replace array with pointer. (Hint: in case of pointers, you have to allocate the memory).

Example Output:

```
Student [1]   =      25      Krish  18
Student [2]   =      28      Ram   19
Student [3]   =      22      Satish 17
```

3. Create 3 nodes, where each node holds one student record. Let the student records be S1, S2 and S3. Each node carries the details of the student (mentioned in the Tut-1 problem) and pointer to the next student. Create a linked list with S1 as the 1st node and S3 as the last node. First enter the details of the student in each node and then provide the link from one node to other. Once the linked list is created, demonstrate the traversal by printing the records in sequence.

Assignment Problems (For All Students)

1. Tut-2 problem
2. Write a C program to read (input) multiple student records from keyboard. Write C functions separately for sorting the student records based on each attribute. Demonstrate the above functions by printing the attribute-based sorted records.

Example Output:

<i>Original student records (before sorting)</i>				<i>Sorted records based on student roll</i>			
<i>Student [1]</i>	=	22	<i>Satish 17</i>	<i>Student [1]</i>	=	22	<i>Satish 17</i>
<i>Student [2]</i>	=	28	<i>Ram 19</i>	<i>Student [2]</i>	=	25	<i>Krish 18</i>
<i>Student [3]</i>	=	25	<i>Krish 18</i>	<i>Student [3]</i>	=	28	<i>Ram 19</i>
<i>Sorted records based on student name</i>				<i>Sorted records based on student age</i>			
<i>Student [1]</i>	=	25	<i>Krish 18</i>	<i>Student [1]</i>	=	22	<i>Satish 17</i>
<i>Student [2]</i>	=	28	<i>Ram 19</i>	<i>Student [2]</i>	=	25	<i>Krish 18</i>
<i>Student [3]</i>	=	22	<i>Satish 17</i>	<i>Student [3]</i>	=	28	<i>Ram 19</i>

3. Write a C program to read (input) multiple student records from keyboard. The attributes of the student record consists of {int roll, char name[20], int age, struct marks M}, marks {float sub1, float sub2, float sub3, float sub4, float total, char result}. Enter the number of

students' records (say "n") through keyboard. Then call a function to enter the attributes of the students records. Write a C function to sort the records based on total marks and provide the grade as per IITKGP grading scheme.

Example Output:

<i>Original student records (before sorting)</i>											
Student [1]	=	22	Satish	17	66	70	87	74	297	B	
Student [2]	=	28	Ram	19	55	90	99	95	339	A	
Student [3]	=	25	Krish	18	22	33	56	90	201	D	
<i>Sorted records based on student total marks</i>											
Student [1]	=	25	Krish	18	22	33	56	90	201	D	
Student [2]	=	22	Satish	17	66	70	87	74	297	B	
Student [3]	=	28	Ram	19	55	90	99	95	339	A	

4. A linked list, where the node of the linked list (data component) holds the student record {int roll, char name[20], int age}. Write C functions to (i) create the list and fill the nodes with student records and (ii) print the student records by traversing the list.
5. Continuation to the above problem: write C functions to (i) insertion of a node (at the beginning, at the end, in between based on some attribute of the student record), (ii) deletion of a node (at the beginning, at the end, in between based on some attribute of the student record) and (iii) print the student records in reverse order.

Assignment Problems (For those who completed 5 assignment problems)

1. Write C program to compute the interest and total amount (principle + interest) for all the account holders of a bank. The details of the account holder are as follows: {int acc_no, char name[20], float principle, struct date deposit_date, float interest, float total}. The attributes of Date are {int date, int month, int year}. Define appropriate structures and input the number of account holders, rate of interest through keyboard. Write C functions to (i) enter the details of account holders, (ii) compute the difference between deposit date and target date, (iii) compute the interest and total amount for each account holder and (iv) print the records in systematic manner.
2. Assume that the linked list holds the data consisting of student records mentioned in Tut-2 problem. Write separate C function to sort the records based on each attribute of the student record. Print the student records in the original order (before sorting) and in sorted order as per each specific attribute.

PDS LAB – 9 (Section-5) Date: 3rd April 2017

Searching & Sorting

Tutorial Problems

1. Write a C program to search an element in a sorted array using binary search method. Input the sorted array through keyboard and print the output as “Element is present” or “Element is not present” based on whether the element is present or not?
2. Assume that the sequence of data elements are present in linked list. First create a linked list and place the data elements in nodes. Write a C function to search the data elements present in the linked list and print the output as the given data element is present along with its position if the data element is present in the list, otherwise the output should indicate that the data element is not present in the list.
3. Write a C program to sort the given array of elements using selection sort technique.

Assignment Problems (For All Students)

1. A student record contains the following fields {int roll_no, char name[20], struct date dob}, where date has the following fields {int date, int month, int year}. Suppose, you have 10 student records, write a C program to search the students records and retrieve the specific student record based on the input date of birth in the given format dd/mm/yy.
2. Extend the Tut-1 problem using ternary search and interpolation search methods.
3. Write a C program to sort the given array of elements using Insertion sort technique.
4. Write a C program to sort the given array of elements using Merge sort technique.
5. Write a C program to sort the given array of elements using Quick sort technique.

Assignment Problems (For those who completed 5 assignment problems)

1. Write C program to sort the English words based on alphabetic order.
2. Write a C program to search the given word in the sorted list of words using binary search technique.
3. Write a C program to search an element in a sorted array using random search method.

PDS LAB – 10 (Section-5) Date: 10th April 2017

Stacks, Queues & Files

Tutorial Problems

1. A stack is a data structure used to maintain data in “Last In First Out (LIFO)” principle. Define the suitable structure to represent the stack using array and linked list. Write the following basic functions involved with stack to carry out the following operations:
 - (i) Create the stack
 - (ii) Check whether stack is empty or full
 - (iii) Placing the element into the stack (PUSH)
 - (iv) Removing the element from stack (POP)
 - (v) Accessing the top element on the stack
 - (vi) Print the elements in the stack

2. A queue is a data structure to maintain data in “First In First Out (FIFO)” principle. Define the suitable structure to represent the queue using array and linked list. Write the following basic functions involved with queue to carry out the following operations:
 - (i) Create the queue
 - (ii) Check whether queue is empty or full
 - (iii) Placing the element into the queue (ENQUEUE)
 - (iv) Removing the element from queue (DEQUEUE)
 - (v) Accessing the front element from the queue
 - (vi) Print the elements in the queue

3. Write a C program to create a file, write some data items into the file and read the contents of the file and print them.

Assignment Problems (For All Students)

1. Write a C program to check whether the given expression is correctly parenthesized using stack.
Input: $[a+(b-c)*\{d/e\}+[f+h]-i]$
Output: The given expression is correctly parenthesized
Input: $[a+(b-c)*\{d/e\}+[f+h]-i]$
Output: The given expression is incorrectly parenthesized

2. Write a C program to check whether the given string is palindrome or not using stack.

3. Write a C program to enter the data items (say integers) in a queue. After the entry of N items, fetch the items and feed to 2 new queues such that the positive numbers will be in

one queue and negative numbers will be in another queue. At the end show the contents of 2 queues which holds the positive and negative numbers.

4. Write a C program to create a file and enter some N data items in first attempt. Next time open the same file and append say M data items to it. Later, fetch the contents of the file and copy them to 2 new files such that even data items will be copied to a file named “evenfile”, and odd items will be copied into “oddfile”. After the operation print the contents of original file (initial one) as well as “evenfile” and “oddfile”.
5. Write a C program to create a file which contains the records of the employees of an organization. The fields of the record are (i) emp_name, (ii) emp_no, (iii) emp_age, (iv) emp_sal. Enter 4-5 employee records into the file. Access each employee’s salary and compute his/her annual income and place it in a new file as fifth field in each of the record. Display the contents of the original file as well as new file.

Assignment Problems (For those who completed 5 assignment problems)

1. Write C program to convert infix expression to postfix expression using stack.
2. Write a C program to implement the Queue using Stacks.
3. Write a C program to create a file and enter student records which contains roll_no, name, age, marks. After entering some N records, access the records and place them in 2 files (“passfile” and “failfile”) based on their performance. If the marks are greater than or equal to 40, then the student has passed otherwise he/she has failed.

Mid-Semester PDS Lab Test

Section-5; Date: 27 Feb 2017; Time: 2.00 to 4.30 pm; Marks: 100

(For ODD MACHINE NUMBERS)

1. Write a C program to compute the following: (*do not use any math functions*) **(25 Marks)**
 - (a) Enter the principle amount and annual rate of interest
 - (b) Assume that the interest is computed in compound manner for annually as well as monthly. You may use the monthly rate of interest as $(1/12)$ of annual rate of interest. Determine the number of months at which the difference in total amount (principle plus interest) is differed by 25%. (*Hint: interest = $(p*n*r)/100$*)
2. Write C functions to (i) compute and return the maximum value of the elements in a given array and (ii) compute and return the position of the given value from an array. **(35 Marks)**

Through main function Read N numbers from key board and place them in an array. By using the above defined functions compute the maximum element of the array and find the position of the maximum element of the array. Finally, remove the maximum element from an array and place it at the last position of the array.

Print the following outputs: (i) Original array after the input from key board, (ii) Maximum value of the array, (iii) Position of the maximum value in the array and (iv) Array after placing the maximum element at the last position.

Example: N=6; array = a[]; max_array = 6.7432; position of max_array = 2;

Array index	a(0)	a(1)	a(2)	a(3)	a(4)	a(5)	a(6)	a(7)	a(8)	a(9)
Input	2.75	1.05	6.7432	1.2345	-8.987	4.05				
Output	2.75	1.05	1.2345	-8.987	4.05	6.7432				

3. Write a C program to print all possible sub-strings of a given string in forward direction. First, accept the input string terminated with new line character. Print the input string collected through key board, and print the sub-strings as shown below: **(40 Marks)**

Input: abcdefg

Output:

```
a      b      c      d      e      f      g
ab     bc     cd     de     ef     fg
abc    bcd    cde    def    efg
abcd   bcde   cdef   defg
abcde  bcdef  cdefg
abcdef bcdefg
abcdefg
```

Mid-Semester PDS Lab Test

Section-5; Date: 27 Feb 2017; Time: 2.00 to 4.30 pm; Marks: 100

(For EVEN MACHINE NUMBERS)

- 1 Write a C program to compute the following: (*do not use any math functions*) **(25 Marks)**
 - (a) Enter the principle amount and monthly rate of interest.
 - (b) Assume that the interest is computed in compound manner for monthly as well as daily. You may use the daily rate of interest as (1/30) of monthly rate of interest. Determine the number of days at which the difference in total amount (principle plus interest) is differed by 15%. (*Hint: interest = $(p*n*r)/100$*)
- 2 Write C functions to (i) compute and return the minimum value of the elements in a given array and (ii) compute and return the position of the given value from an array. **(35 Marks)**

Through main function Read N numbers from key board and place them in an array. By using the above defined functions compute the minimum element of the array and find the position of the minimum element of the array. Finally, remove the minimum element from an array and place it at the initial (first) position of the array.

Print the following outputs: (i) Original array after the input from key board, (ii) Minimum value of the array, (iii) Position of the minimum value in the array and (iv) Array after placing the minimum element at the initial (first) position.

Example: N=6; array = a[]; min_array = -8.987; position of min_array = 4;

Array index	a(0)	a(1)	a(2)	a(3)	a(4)	a(5)	a(6)	a(7)	a(8)	a(9)
Input	2.75	1.05	6.7432	1.2345	-8.987	4.05				
Output	-8.987	2.75	1.05	6.7432	1.2345	4.05				

- 3 Write a C program to print all possible sub-strings of a given string from the end in reverse order. First, accept the input string terminated with new line character. Print the input string collected through key board, and print the sub-strings as shown below: **(40 Marks)**

Input: abcdefg

Output:

```
g      f      e      d      c      b      a
gf     fe     ed     dc     cb     ba
gfe    fed    edc    dcb    cba
gfed   fedc   edcb   dcba
gfedc  fedcb  edcba
gfedcb fedcba
gfedcba
```

Mid-Semester PDS Lab Test (Section-5)

Re-examination (Medical Ground)

Time: 2 hrs

1. Write a C program that accepts text from keyboard and print the total number of words, number of unique words and their frequencies.

Example:

Input: IIT Kharagpur IIT Mumbai IIT Hyderabad IISC Bangalore IITG IIM Alhabad IIM Bangalore IIT Ganghinagar

Output:

Total Number of words = 15

Number of Unique words = 10

Frequency of Occurrence: IIT – 4; Kharagpur – 1; Mumbai – 1; Hyderabad – 1; IISC – 1; Bangalore – 2; IITG – 1; IIM – 2; Alhabad – 1; Ganghinagar – 1;

2. Write a C program to rearrange array in alternating positive and negative numbers. Number of positive and negative numbers need not be equal. Finally, in the output, the sequence of positive or negative numbers should follow ascending order.

Example:

Input: {1, 2, 3, -4, -1, 4}

Output: {-4, 1, -1, 2, 3, 4}

Input: {-5, -2, 5, -2, -4, -7, -1, 8, 0, -8}

output: {-8, 0, -7, 5, -5, 8, -4, -2, -2, -1}

End-Semester PDS Lab Test

Section-5; Date: 17th April 2017; Time: 2.00 to 5.00 pm; Marks: 100

(For ODD MACHINE NUMBERS)

Name:

Roll No:

Machine No:

Instructions:

- I. The source code should have proper indentation and comments. Ensure the source code should be readable and understandable.*
 - II. The source code should be more generic such that during execution it should be more user-friendly. The code should work for any input, it should not consider any specific input.*
-

1. Write a C program using pointers to carry out the following task:

- (a) Enter the float values say N through keyboard and print the same.
- (b) Determine the range of values entered by computing minimum and maximum of the values entered. Split the range into 4 equal intervals. Print the range of numbers entered and intervals computed.
- (c) Count the number of values present in each interval, print the intervals and number of values (count) associated to each interval.

Example:

Input : 55, 41, 62, 75, 13, 82, 4, 99, 32, 59, 7, 17, 24, 38, 43, 62, 71, 84, 97, 60

Range = 4 – 99 (minimum = 4, maximum = 99)

Interval-1 = 4 – 27

Interval-2 = 28 – 51

Interval-3 = 52 – 75

Interval-4 = 76 – 99

Interval-1 = 4 – 27 5

Interval-2 = 28 – 51 4

Interval-3 = 52 – 75 7

Interval-4 = 76 – 99 4

2. Write a C program to perform the following tasks using linked lists:

- a) Create a linked list and enter N values into the list such that each node carries one value.
- b) Traverse the list and print the values in the sequence as they are entered.
- c) Access each node of linked list, if the value present in the node is negative, then remove the node from the list and place the value in the new list.
- d) Traverse the new list as well as updated old list and print the values present in the lists.

Example: 23, 44, -12, 53, -7, 15, -45, 87

Output: New List = -12, -7, -45;

Updated old list = 23, 44, 53, 15, 87

3. Write a C program to evaluate the given postfix expression using stack. First define the structure of the stack and use the basic functions of the stack to evaluate the postfix expression. Consider the digits 1 to 9 for representing operands, four basic arithmetic operations (+ - * /) as operators and maximum length of the expression is 20.

Example: $6\ 8 -\ 4\ 2 +\ /\ 8\ 9\ /\ 5\ 8\ *\ -\ *$

Sequence of computations are as follows:

- (1) $6 - 8 = -2$
- (2) $4 + 2 = 6$
- (3) $-2 / 6 = -0.33$
- (4) $8 / 9 = 0.89$
- (5) $5 * 8 = 40$
- (6) $0.89 - 40 = -39.11$
- (7) $-0.33 * -39.11 = 12.91$

End-Semester PDS Lab Test

Section-5; Date: 17th April 2017; Time: 2.00 to 5.00 pm; Marks: 100

(For EVEN MACHINE NUMBERS)

Name:

Roll No:

Machine No:

Instructions:

- I. The source code should have proper indentation and comments. Ensure the source code should be readable and understandable.*
 - II. The source code should be more generic such that during execution it should be more user-friendly. The code should work for any input, it should not consider any specific input.*
-

1. Write a C program using pointers to carry out the following tasks:

- (a) Enter the sequence of characters (string) terminated by end of line and print the same.
- (b) Determine the count of vowels and consonants present in the input characters.
- (c) Determine the counts associated to successive 2 characters satisfy the following: (i) both vowels and (ii) both are same (repetition).

Example: "asdeausdggkouu"

Count of vowels = 7

Count of consonants = 7

Count of 2 successive characters to be vowels = 4

Count of 2 successive characters to be same character = 2

2. Write a C program to perform the following task using linked lists:

- a) Create a linked list and enter N positive integer values into the list such that each node carries one value.
- b) Traverse the list and print the values in the sequence as they are entered.
- c) Traverse the list and insert the new nodes such that successive nodes should not have either both even or both odd values. Suppose, if 2 successive nodes have even values 64 and 72, then we need to insert a new node in between them and place the value as one more than the value of previous node (i.e., 65).
- d) Traverse the updated list and print the values present in the list.

Example: 23, 44, 12, 53, 7, 15, 45, 87

Output: 23, 44, 45, 12, 53, 54, 7, 8, 15, 16, 45, 46, 87

3. Write a C program to evaluate the given prefix expression using stack. First define the structure of the stack and use the basic functions of the stack to evaluate the prefix expression. Consider the digits 1 to 9 for representing operands, four basic arithmetic operations (+ - * /) as operators and maximum length of the expression is 20.

Example: + / * 6 - 2 5 + 9 7 - / 4 3 + 2 4

(1) $4 + 2 = 6$

(2) $3 / 4 = 0.75$

(3) $6 - 0.75 = 5.25$

(4) $7 + 9 = 16$

(5) $5 - 2 = 3$

(6) $3 * 6 = 18$

(7) $16 / 18 = 0.89$

(8) $5.25 + 0.89 = 6.14$