

**Laboratory Plan****FMTH0303-3.1****Semester: I****Year: 2021-2022**

Laboratory Title: C Programming for Problem Solving	Lab. Code: 18ECSP101
Total Hours: 78	Duration of Exam: 3 hours
Total Exam Marks: 20	Total ISA. Marks: 80
Lab. Plan Authors:	Date: 25-10-2021
Priyadarshini D.K    Vidya S.H.    Vijay Biradar    Kavitha H. S.	
Nagaratna Y    Shivalingappa B    Bhagya S    Sandeep K	
Altaf H    Ashwini K    Sheela B    Vidyashri H	
Checked By: Sujatha C.	Date: 27-10-2021

**Preamble:**

This course is introduced to learn basics of programming language and to develop problem solving skills. At the end of the course the student should be able to develop algorithmic solution for a given problem. Apply programming skills and coding standards to write programs. The course also focuses on Debugging, creating test cases for a problem and code optimization. The course builds a foundation for learning any other programming language and also prerequisite for Problem Solving through Data Structures course. Knowledge of C is highly marketable for summer internships, UROPs, and in system software and embedded systems development.

**Course Outcomes****At the end of the course students will be able to:**

- Apply logical thinking to develop an algorithm to solve a problem.
- Implement C program using appropriate construct to solve a given problem.
- Trace a C program.
- Create test cases for a given problem.
- Apply programming skills using standard online coding platform.
- Work collaboratively to share knowledge, skills and experience.

**Course Articulation Matrix: Mapping of Course Outcomes (CO) Program outcomes**

Laboratory Title: C Programming for Problem solving Laboratory

Code: 18ECSP101

Semester: I

Year: 2021-2022

Course Outcomes / Program Outcomes	1	2	3	4	5	6	7	8	9	10	11	12
1. Apply logical thinking to develop an algorithm to solve a problem	M	H										
2. Write C program using appropriate constructs to solve a given problem.	M	H										
3. Trace a C program.		L										
4. Create test cases for a given problem.		M										
5. Apply programming skills to solve a problem using standard online coding platform.		M			M							
6. Work collaboratively to share knowledge, skills and experience.	M	M							M			

Degree of compliance L: Low M: Medium H: High

**Competency addressed in the Course and corresponding Performance Indicators**

Competency	Performance Indicators
CSPI 1.3.1	Apply fundamental engineering principals and laws.
CSPI 1.3.6	Apply programming concepts
CSPI 2.1.3	Evaluate problem statements and identify objectives.
CSPI 2.1.6	Use processes/techniques for problem analysis.
CSPI 5.1.1	Identify modern engineering tools, techniques and resources for engineering activities.
CSPI 9.2.1	Demonstrate effective communication, problem solving conflict resolution and leadership skills.

Eg: 1.3.1: Represents program outcome '1', competency '3' and performance indicator '1'.

### Course Content

Course Code: <b>18ECSP101</b>	Course Title: <b>C Programming for Problem Solving</b>	
L-T-P: <b>0-0-3</b>	Credits: <b>3</b>	Contact Hrs: <b>6 hrs/week</b>
ISA Marks: <b>80</b>	ESA Marks: <b>20</b>	Total Marks: <b>100</b>
Teaching Hrs: <b>78</b>		Exam Duration: <b>03 hrs</b>

<b>1</b>	<b>Introduction to Problem solving</b> Introduction to algorithms / flowcharts and its notations, top down design, elementary problems.	<b>03</b>
<b>2</b>	<b>Basics of C programming language</b> Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators, Data-types, Input and Output statements.	<b>15</b>
<b>3</b>	<b>Decision control statements</b> Conditional branching statements: if statement, if else statement, else if ladder, switch statement, unconditional branching statements: break, continue. Introduction to Debugging Skills. Introduction to Test Driven Programming.	<b>12</b>
<b>4</b>	<b>Iterative statements</b> while, do while, for, Nested statements.	<b>10</b>
<b>5</b>	<b>Functions</b> Introduction, Function declaration, definition, call, returns statement, passing parameters to functions, Introduction to macros and Coding Standards.	<b>10</b>
<b>6</b>	<b>Arrays and Strings</b> Introduction, Declaration, Accessing elements, Storing values in arrays, Operations on one dimensional array, Operations on two dimensional arrays.	<b>15</b>
<b>7</b>	<b>Pointers</b> Introduction, declaring pointer, pointer variables, pointer expression and arithmetic, passing arguments to functions using pointers, pointers and arrays, passing an array to a function.	<b>08</b>
<b>8</b>	<b>Structures and Unions</b> Introduction, passing structures to functions, Array of structures, Unions	<b>05</b>

### Text Books

1. Elliot B. Koffman ,Jeri R. Hanly Problem Solving and Program Design in C,8<sup>th</sup> ed,PHI, 2016
2. Yashvant Kanetkar, Let us C, 17<sup>th</sup> ed, BPS Publication, 2018.

### Reference Books:

1. B W Kernighan, D M Ritchie, The Programming language C, 2<sup>nd</sup>ed, PHI, 2015.
2. R.G.Dromey, How to Solve it by Computer, 1<sup>st</sup>ed, PHI, 2008.
3. B S Gottfried, Programming with C (Schaum's Outlines Series), 4<sup>th</sup> ed, TMH, 2018.2008.

Evaluation Criteria	
Assessment	Weightage in Marks
ISA	80
ESA	20
Total	100

ISA Assessment		Weightage in Marks
TERMWORKS / Assignment		
1	Applying problem solving framework to solve a problem.	08
2	Decision Control Statement	10
3	Iterative Statements	10
4	1D Arrays and Strings.(Hacker rank)	15
5	2D Arrays	12
6	Structured Enquiry	15
7	Post Test	10
<b>Total</b>		<b>80</b>

Date:

Head  
SoCSE

### Course Assessment plan

18ECSP101:C Programming for Problem Solving							
Course Outcomes		Weightage in %Assessment	ISA				ESA
			Demo	Exercise	Str. Enquiry	Open Ended	
18ECSP101.1	Apply logical thinking to develop an algorithm to solve a problem	30%	-	✓	✓	-	✓
18ECSP101.2	Write C program using appropriate constructs to solve a given problem.	35%	-	✓	✓	-	✓
18ECSP101.3	Trace a C program.	04%	-	✓	-	-	-
18ECSP101.4	Create test cases for a given problem.	20%	-	✓	✓	-	✓
18ECSP101.5	Apply programming skills to solve a problem using standard online coding platform.	06%	-	✓	-	-	-
18ECSP101.6	Work collaboratively to share knowledge, skills and experience.	05%	-	-	✓	-	-

### Experiment wise Plan

**List of experiments/jobs planned to meet the requirements of the course.**

Category: Demonstration		Total Weightage: 0.00		No. of lab sessions: 18
Expt./ Job No.	Experiment / Job Details	No. of Lab Session(s) per batch (estimate)	Marks / Experiment	Correlation of Experiment with the theory
1.	<ul style="list-style-type: none"> <li>• Introduction to problem solving framework.</li> <li>• Introduction to algorithms and its notations</li> <li>• Top down design</li> <li>• Fundamentals of algorithms</li> <li>• Writing Algorithm for a given problem statement.</li> </ul>	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Explain the process of problem solving for a given problem.</li> <li>2. Apply problem solving framework to solve a problem.</li> <li>3. Develop logical thinking with an algorithmic approach to solve specific problem.</li> </ol>			Problem solving framework, Algorithms and its notations, fundamental algorithms.
2	Basics of C programming language: Structure of C program, C Tokens, Evaluation of Expressions	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Explain the basics concepts of C programming language: identifiers, constants, data types, keywords.</li> <li>2. Use different types of operators to construct and evaluate the expressions:</li> </ol>			Characteristics and uses of C, Structure of C program, C Tokens: Keywords, Identifiers, Variables, Constants, Operators

3	<ul style="list-style-type: none"> <li>• Introduction to Data types</li> <li>• Introduction to Input and Output statements.</li> </ul>	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Understand basic data types.</li> <li>2. Explain how to read and write data using input and output statements.</li> <li>3. Write the C code for a given algorithm.</li> </ol>			Data-types, Input and Output statements
4	<ul style="list-style-type: none"> <li>•Introduction to code blocks Integrated Development Environment (IDE).</li> <li>•Introduction to Decision Control Statements: if, if else.</li> <li>• Execute Simple C programs using if and if else statements.</li> </ul>	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Learn how to compile, link and execute the C programs.</li> <li>2. Explain the working of one way and two-way decision making constructs.</li> <li>3. Develop familiarity for Integrated Development Environment.</li> <li>4. Apply appropriate branching construct(s) to solve a given problem.</li> </ol>			Decision Control Statements
5	Introduction to else if ladder and switch statements.	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1.Explain the working of multi-way decision making constructs.</li> <li>2.Predict the output of the given code snippet.</li> <li>3.Apply appropriate branching construct(s) to solve a given problem.</li> </ol>			Decision Control Statements
6	• Programs on Decision	1	0.00	

	Control Statements. • Introduction to Online Coding Platform (Hackerrank)			
	<b>Learning Outcomes:</b> The students should be able to: 1. Apply appropriate branching construct(s) to solve a given problem.			Decision Control Statements
7	Introduction to Iterative Statements: while, do while, and for	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: 1. Explain the working of different looping constructs. 2. Write a C program using appropriate looping constructs.			Iterative Statements
8	Program execution using suitable looping constructs	1	0.00	Iterative Statements
	1. Write a C program using appropriate looping constructs.			
9	Demonstration of online coding platform			Iterative Statements
	Nested loop statements	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: 1. Explain the working of nested loop statements. 2. Predict the output of the given code snippet. 3. Write a C program using appropriate looping constructs.			Iterative Statements
10	Introductions to functions and coding standards.	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: 1. Explain the need for modular programming. 2. Explain the elements of User defined functions.			Functions
11	• Passing Parameters to functions and Introduction to macros.	1	0.00	



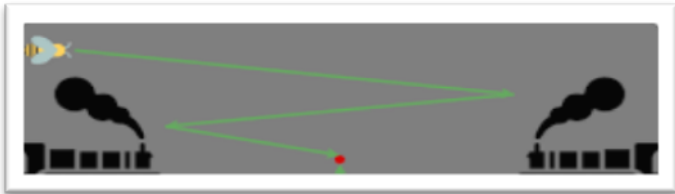
	<ul style="list-style-type: none"> <li>Write a C program using functions and macros by applying Coding Standards.</li> </ul>			
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>Demonstrate the ability to analyze simple programs that use library or User defined functions.</li> <li>Explain the communication between two functions by using different types of functions.</li> </ol>			Functions and Coding Standards
12	Introduction to Arrays: 1-Dimensional Arrays	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>Define, describe and explain array data structure.</li> <li>Explain how to read and display 1D array elements.</li> <li>Implement different operations on 1D arrays: traversal, search, merge, insertion, deletion, sort.</li> </ol>			1-Dimensional Arrays
13	Program implementation using 1-Dimensional Arrays	1	0.00	
	1. Implement different applications of 1D arrays.			
14	2-Dimensional Arrays	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>Explain how to read and display 2D array elements.</li> <li>Implement different operations on matrix.(addition, multiplication)</li> </ol>			2-Dimensional Arrays
15	<ul style="list-style-type: none"> <li>Introduction to Strings and String operations</li> <li>Implementation of string operations.</li> </ul>	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>Demonstrate the usage of string manipulation functions.</li> <li>Implement string manipulation functions: strlen(), strcpy(), strcat(), strcmp().</li> </ol>			String operations

16	<ul style="list-style-type: none"> <li>•Introduction to Pointers: Declaration of Pointer Variables</li> <li>• Pointer and Arrays</li> </ul>	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Understand the limitations of basic data types.</li> <li>2. Understand the common errors introduced by pointers.</li> <li>3. Understand the relation between 1D Arrays and Pointers.</li> <li>4. Understand pointer arithmetic with arrays.</li> <li>5. Write a C program using pointers.</li> </ol>			Pointers
17	Implement Modular Programs on Pointers and Arrays	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Write a C program using pointers and pointers to arrays.</li> <li>2. Predict the output of the given code snippet.</li> </ol>			Pointers
18	<ul style="list-style-type: none"> <li>•Introduction to Structures: Passing Structures to Functions</li> <li>• Array of Structures</li> <li>• Modular Programming using Structures</li> </ul>	1	0.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Understand the limitations of basic data types and derived data types and learn the concepts of user defined data types.</li> <li>2. Write modular program using structures.</li> </ol>			Structures
<b>Category: Exercise</b>		<b>Total Weightage: 65.00</b>		<b>No. of lab sessions: 5</b>
<b>Expt./ Job No.</b>	<b>Experiment / Job Details</b>	<b>No. of Lab Session(s) per batch (estimate)</b>	<b>Marks/ Experiment</b>	<b>Correlation of Experiment with the theory</b>
1	TERMWORK: Apply Problem Solving	1	8.00	

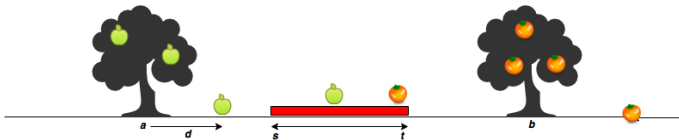
	Framework for a given problem statement			
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. To understand steps involved in solving a problem.</li> <li>2. Develop logical thinking with an algorithmic approach to solve specific problems.</li> </ol>			Introduction to Problem Solving
2	TERMWORK: Decision Control Statements.	1	10.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Write Programs using Decision Control Statements.</li> <li>2. Apply problem solving framework and write program using Decision Control Statements.</li> </ol>			Decision Control Statements.
3	TERMWORK: Iterative Statements	1	10.00	
	<b>Learning Outcomes: (online)</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Write programs using iterative statements.</li> <li>2. Use the Online Coding Platform to solve the given test cases for the problem statement.</li> </ol>			Iterative Statements
4	TERMWORK: 1D Arrays and Strings	1	15.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Write and Use industry standard tool to implement modular program on 1-D arrays.</li> <li>2. Write test cases for the given problem statement.</li> <li>3. Write and implement modular C programs on Strings.</li> </ol>			1Dimensional Arrays
5	TERMWORK: 2D Arrays	1	12.00	
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Write and implement modular programs on 2D arrays.</li> <li>2. Write test cases for the given problem statement.</li> </ol>			2 Dimensional Arrays
6	Post Test		10.00	All Concepts
<b>Category: Structured Enquiry</b>		<b>Total Weightage: 15.00</b>		<b>No. of lab sessions: 2</b>

Expt./ Job No.	Experiment / Job Details	No. of Lab Session(s) per batch (estimate)	Marks / Experiment	Correlation of Experiment with the theory
1	TERMWORK: All Concepts	2	15.00	All Concepts
	<b>Learning Outcomes:</b> The students should be able to: <ol style="list-style-type: none"> <li>1. Apply problem solving framework to solve a problem.</li> <li>2. Write test cases for the given problem statement.</li> <li>3. Write and implement modular C program for a given problem.</li> </ol>			

### Review Questions

Sl.No	Questions
<b>Apply Problem Solving Framework for all the problems</b>	
<b>Algorithms</b>	
1	A cashier has currency notes of denominations 1, 2, 5, 10, 20, 50, 100, 200, 500 and 2000. If the amount to be withdrawn is input through the keyboard, apply problem solving framework to find the total number of currency notes of each denomination the cashier will have to give to the withdrawer.
2	Ram completed his MBA Post Graduation in 2020. He joined as a manager in a Soup manufacturing and packing industry. The management assigned him the responsibility of purchasing the papers for soup can labels. The company has manufactured 1000 soup cans, each of which is 3.5 inches in diameter and 5 inches in height. The paper which is used to make label, costs Rs 10/square inch. Ram need to calculate the cost needed to purchase the papers needed to make the label for the soup cans. Apply problem solving framework to solve the problem.
3	<p>Two trains are on same track and they are coming toward each other. The speed of the first train is <math>X</math> km/h and the speed of the second train is <math>Y</math> km/h. A bee starts flying between the trains when the distance between two trains is <math>N</math> km. The bee first flies from first train to second train. Once it reaches the second train, it immediately flies back to the first train ... and so on until trains collide. Calculate the total distance travelled by the bee. Speed of bee is <math>Z</math> km/h.</p> 
4	Sebi goes to school daily with his father. They cross a big highway in the car to reach to the school. Sebi sits in front seat beside his father at driving seat. To kill boredom, they play a game of guessing speed of other cars on the highway. Sebi makes a guess of other car's speed being $S$ kph, his father $F$ kph. The highway is usually empty, so the drivers use cruise control, i.e. vehicles run at a constant speed. There are markers on the highway at a gap of 50 meters. Both father-son duo wants to check the accuracy of their guesses. For that, they start a timer at the instant at which their car and the other car (which speed they are guessing) are parallel to each other (they need not to be against some marker, they can be in between the markers too). After some $T$ seconds, they observe that both the cars are next to some markers and the number of markers in between the markers

	of their car and the other car is D - 1 (excluding the markers next to both the cars). Also, they can observe these markers easily because the other car is faster than their. Speed of Sebi's father's car is S. Using this information; one can find the speed of the other car accurately.
5	In a shopping mall there is a End_Of_Season sale of Rs 500 each on clothing, they have announced 10% discount on Men's wear, 20% discount on women's ware and 15% discount on kids wear. Ram purchased two T-shirts of Rs 500 each, one women's top of Rs 1000 and two kids dress of Rs 500 each. Apply problem solving framework to compute the total price he has to pay after discount.
6	Apply problem solving framework that calculates the acceleration (m/s <sup>2</sup> ) of a jet fighter launched from an aircraft carrier catapult, given the jet's takeoff speed in km/hr and the distance (meters) over which the catapult accelerates the jet from rest to takeoff. Assume constant acceleration. Also calculate the time (seconds) for the fighter to be accelerated to takeoff speed. Relevant formulas: $v=at$ $s=1/2 at^2$ For example takeoff speed = 278km/hr , distance = 94 meters
7	Apply problem solving framework to compute the weighted score based on individual assignments' scores. Let us say there are only 3 assignments & 2 exams, each with a max score of 100. Respective weights are (10%, 10%, 10%, 35% and 35%). Weighted Score = assignment1 + assignment2 + assignment 3 + exam1 + exam2
8	Ram purchased 3 items from the grocery shop, original price of the items are 150,200,280 rupees and GST (Goods and Services Tax) is 2% on each item which is included in net price of product. Apply problem solving framework to compute the total amount he has to pay for the grocery shop owner.
9	One of our beloved Senior brothers has to do a lot of <b>date &amp; Time</b> calculation in his busy life. He always wants to know the date after 'X' days. He wants to give less effort to do this calculation. Can you make it easy for him? <b>Sample Input</b> 10-12-2020 12 <b>Output</b> 22-12-2020 <b>Input</b> 29-02-2016 1010 <b>Output</b> 05-12-2018

10	<p>Ram's house has an apple tree and an orange tree. In the diagram below, the red region denotes his house, where <math>s</math> is the start point, and <math>t</math> is the endpoint. The apple tree is to the left of his house, and the orange tree is to its right. You can assume the trees are located on a single point, where the apple tree is at point <math>a</math>, and the orange tree is at point <math>b</math>.</p>  <p>When a fruit falls from its tree, it lands <math>d</math> units of distance from its tree of origin along the <math>x</math>-axis. A negative value of <math>d</math> means the fruit fell <math>d</math> units to the tree's left, and a positive value of <math>d</math> means it falls <math>d</math> units to the tree's right. Given the value of <math>d</math> for 1 apple and 1 orange, determine how many apples and oranges will fall on Sam's house (i.e., in the inclusive range <math>[s,t]</math>)?</p>
11	<p>The eligibility to write semester end exam is that the student should have minimum of 85% attendance and minimum of 32 marks in CIE. Apply problem solving framework to test whether a student is eligible to attend the semester end exam given the above criteria.</p>
12	<p>A shopkeeper purchased TV sets from wholesaler at a rate of Rs. 4000 each. He marked up the price of TV sets by 28% and sells each set at a discount of 12% to its customer. Find how much profit he gets on each set of TV. Apply problem solving framework to solve the problem.</p>
13	<p>A computer manufacturing company has the following monthly compensation policy to their sales-persons:</p> <p>Minimum base salary: 15000.00</p> <p>Bonus for every computer sold: 1000.00</p> <p>Commission on the total monthly sales: 2 percent</p> <p>Since the prices of computers are changing, the sales price of each computer is fixed at the beginning of every month. Apply problem solving framework to compute a sales-person's gross salary.</p>
<b>Apply Problem Solving Framework and Write C program for all the problems.</b>	
<b>Decision Control Statements</b>	
1	<p>Marie invented a Time Machine and wants to test it by time-traveling to visit Russia on the Day of the Programmer (the 256th day of the year) during a year in the inclusive range from 1920 to 2700. In calendar systems, February is the only month with a variable amount of days; it has 29 days during a leap year, and 28 days during</p>

	<p>all other years. Leap years are either of the following:</p> <ul style="list-style-type: none"><li>-Divisible by 400.</li><li>-Divisible by 4 and not divisible by 100.</li></ul> <p>Given a year, y, find the date of the 256th day of that year according to the calendar during that year. Then print it in the format dd.mm.yyyy, where dd is the two-digit day, mm is the two-digit month, and yyyy is y. Apply problem solving framework.</p>																		
2	<p>"Mahatma Gandhi National Rural Employment Guarantee Act" or MGNREGA, is an Indian labour law and social security measure that aims to guarantee the 'right to work'. It aims to enhance livelihood security in rural areas by providing at least 100 days of wage employment in a financial year to every household whose adult members volunteer to do unskilled manual work. The daily wage table of the MGNREGA is as shown below.</p> <table><tr><th>Worker</th><th>Hours of work</th><th>Wages/hour</th></tr><tr><td>Male Worker</td><td>1-6hrs</td><td>50rs/hour</td></tr><tr><td>Female Worker</td><td>1-6hrs</td><td>40rs/hour</td></tr><tr><td>Male Worker</td><td>7-10hrs</td><td>80rs/hour after 6 hours</td></tr><tr><td>Female Worker</td><td>7-10hrs</td><td>60rs/hour after 6 hours</td></tr><tr><td>Male Worker/Female Worker</td><td>Excess of 10hrs</td><td>150rs/hour after 10 hours</td></tr></table> <p>Apply problem solving framework to calculate the total wage that the male or female worker will get that day.</p> <p><b>Note: For male workers read ‘M’. For female workers read ‘F’.</b></p>	Worker	Hours of work	Wages/hour	Male Worker	1-6hrs	50rs/hour	Female Worker	1-6hrs	40rs/hour	Male Worker	7-10hrs	80rs/hour after 6 hours	Female Worker	7-10hrs	60rs/hour after 6 hours	Male Worker/Female Worker	Excess of 10hrs	150rs/hour after 10 hours
Worker	Hours of work	Wages/hour																	
Male Worker	1-6hrs	50rs/hour																	
Female Worker	1-6hrs	40rs/hour																	
Male Worker	7-10hrs	80rs/hour after 6 hours																	
Female Worker	7-10hrs	60rs/hour after 6 hours																	
Male Worker/Female Worker	Excess of 10hrs	150rs/hour after 10 hours																	
3	<p>Anand and his family would like to go for a North Karnataka trip. Since Anand do not have his own car, he would like to hire a Taxi. Anand visits “TRAVELL EASY” Taxi Company in Hubballi to hire a car. The company manager told Anand that, the charges vary based on the type of the car chosen for the trip. Anand choses INNOVA CRYSTA car for the trip. Company charges some minimum amount for each day of travel and certain amount for each kilometer travel. The manager showed the following table to Anand.</p>																		



	<table><tr><th>No of days of Travel</th><th>Minimum Kilometers of travel considered/Day</th><th>Charges applicable/ Kilometer travel</th><th>Driver Allowance/ Day</th></tr><tr><td>1-3</td><td>300Km</td><td>9.5Rs</td><td>350Rs</td></tr><tr><td>4-6</td><td>250Km</td><td>9.0Rs</td><td>300Rs</td></tr><tr><td>7-9</td><td>200Km</td><td>8.0Rs</td><td>250Rs</td></tr><tr><td>Above 9days</td><td colspan="3">Display a message “ Company Won’t allow to Travel”</td></tr></table> <p>Read the number of days of travel and total kilometers traveled. Apply problem solving framework to calculate the total amount to be paid by Anand.</p> <table><tr><td><b>Sample Input/Output 1:</b></td><td><b>Sample Input/Output 2:</b></td></tr><tr><td>No.of Days=5</td><td>No.of Days=7</td></tr><tr><td>No. of Kilometers Traveled=800</td><td>No. of Kilometers Traveled=2000</td></tr><tr><td>Amount=(250*5)*9.0+(300*5)=12750Rs</td><td>Amount=(2000*8.0)+(250*7)=17750Rs.</td></tr></table>	No of days of Travel	Minimum Kilometers of travel considered/Day	Charges applicable/ Kilometer travel	Driver Allowance/ Day	1-3	300Km	9.5Rs	350Rs	4-6	250Km	9.0Rs	300Rs	7-9	200Km	8.0Rs	250Rs	Above 9days	Display a message “ Company Won’t allow to Travel”			<b>Sample Input/Output 1:</b>	<b>Sample Input/Output 2:</b>	No.of Days=5	No.of Days=7	No. of Kilometers Traveled=800	No. of Kilometers Traveled=2000	Amount=(250*5)*9.0+(300*5)=12750Rs	Amount=(2000*8.0)+(250*7)=17750Rs.
No of days of Travel	Minimum Kilometers of travel considered/Day	Charges applicable/ Kilometer travel	Driver Allowance/ Day																										
1-3	300Km	9.5Rs	350Rs																										
4-6	250Km	9.0Rs	300Rs																										
7-9	200Km	8.0Rs	250Rs																										
Above 9days	Display a message “ Company Won’t allow to Travel”																												
<b>Sample Input/Output 1:</b>	<b>Sample Input/Output 2:</b>																												
No.of Days=5	No.of Days=7																												
No. of Kilometers Traveled=800	No. of Kilometers Traveled=2000																												
Amount=(250*5)*9.0+(300*5)=12750Rs	Amount=(2000*8.0)+(250*7)=17750Rs.																												
4	<p>Sameer has a bearing manufacturing company in Hubballi. He has a total of 150 full time employees working in the company. Recently Sameer got a BIG consignment of manufacturing bearings. Now the consignment has to be completed within a week, Sameer felt that he can’t manage this work with his full time employees. He decided to hire few part time employees on daily payment basis. Sameer decided to pay them as per the following chart.</p> <table><tr><th>No of days of work</th><th>Minimum hours of work considered/day</th><th>Payment/Hour</th><th>Additional Allowance/ Day</th></tr><tr><td>1-3</td><td rowspan="3">6</td><td>250Rs</td><td>100Rs</td></tr><tr><td>4-6</td><td>350Rs</td><td>150Rs</td></tr><tr><td>7-9</td><td>450Rs</td><td>250Rs</td></tr></table> <p>Apply problem solving framework to calculate the total payment that an employee gets.</p> <table><tr><td><b>Sample Input/Output 1:</b></td><td><b>Sample Input/Output 2:</b></td></tr><tr><td>No.of Days=5</td><td>No.of Days=7</td></tr><tr><td>No. of Hours worked=35</td><td>No. of Hours worked=34</td></tr><tr><td>Amount=(350*35)+(150*5)</td><td>Amount=(450*42)+(250*7)</td></tr></table>	No of days of work	Minimum hours of work considered/day	Payment/Hour	Additional Allowance/ Day	1-3	6	250Rs	100Rs	4-6	350Rs	150Rs	7-9	450Rs	250Rs	<b>Sample Input/Output 1:</b>	<b>Sample Input/Output 2:</b>	No.of Days=5	No.of Days=7	No. of Hours worked=35	No. of Hours worked=34	Amount=(350*35)+(150*5)	Amount=(450*42)+(250*7)						
No of days of work	Minimum hours of work considered/day	Payment/Hour	Additional Allowance/ Day																										
1-3	6	250Rs	100Rs																										
4-6		350Rs	150Rs																										
7-9		450Rs	250Rs																										
<b>Sample Input/Output 1:</b>	<b>Sample Input/Output 2:</b>																												
No.of Days=5	No.of Days=7																												
No. of Hours worked=35	No. of Hours worked=34																												
Amount=(350*35)+(150*5)	Amount=(450*42)+(250*7)																												
5	<p>A commercial Bank accepts Fixed Deposits from the public. The rates of interest vary depending on the number of days for which the deposits are made. The following are the rate of Interest.</p> <table><tr><th>Number of Days</th><th>Rate of Interest</th></tr></table>	Number of Days	Rate of Interest																										
Number of Days	Rate of Interest																												

	<table><tr><td>30 to 60 days</td><td>6%</td></tr><tr><td>61 days to 90 days</td><td>6.5%</td></tr><tr><td>91 days to 180 days</td><td>7%</td></tr><tr><td>181 days to one year</td><td>8%</td></tr><tr><td>More than one year</td><td>8.5%</td></tr></table> <p>For senior citizens, additional 1% is offered for deposits more than 50000.</p> <p>Apply problem solving framework to accept the amount deposited and the number of days for which the deposit is made and calculate the amount to be given to the customer after the maturity of the deposits.</p> <p><b>NOTE: Person with age above 60 will be considered as senior citizen.</b></p>	30 to 60 days	6%	61 days to 90 days	6.5%	91 days to 180 days	7%	181 days to one year	8%	More than one year	8.5%								
30 to 60 days	6%																		
61 days to 90 days	6.5%																		
91 days to 180 days	7%																		
181 days to one year	8%																		
More than one year	8.5%																		
6	<p>A cloth showroom has announced the following seasonal discounts on purchase of items:</p> <table><tr><td>Purchase amount</td><td colspan="2">Discount</td></tr><tr><td></td><td>Mill cloth</td><td>Handloom items</td></tr><tr><td>0-100</td><td>--</td><td>5%</td></tr><tr><td>101-200</td><td>5%</td><td>7.5%</td></tr><tr><td>201-300</td><td>7.5%</td><td>10%</td></tr><tr><td>Above 300</td><td>10%</td><td>15%</td></tr></table> <p>Apply problem solving framework to compute the net amount to be paid by a customer.</p>	Purchase amount	Discount			Mill cloth	Handloom items	0-100	--	5%	101-200	5%	7.5%	201-300	7.5%	10%	Above 300	10%	15%
Purchase amount	Discount																		
	Mill cloth	Handloom items																	
0-100	--	5%																	
101-200	5%	7.5%																	
201-300	7.5%	10%																	
Above 300	10%	15%																	
7	<p>Admission to a professional course is subjected to the following conditions.</p> <p>a)Marks in mathematics <math>\geq 60</math></p> <p>b)Marks in Physics <math>\geq 50</math></p> <p>c) Marks in Chemistry <math>\geq 40</math></p> <p>d)Total in all subjects <math>\geq 200</math> OR Total in Mathematics and Physics <math>\geq 150</math></p> <p>Apply problem solving framework to read marks in 3 subjects and check whether the candidate is eligible to take the course or not.</p>																		
8	<p>The daily wages for a workers are as follows</p> <table><tr><td>Worker</td><td>Hours</td><td>Wages</td></tr><tr><td>Male Worker</td><td>0-6hrs</td><td>200rs</td></tr><tr><td>Female Worker</td><td>0-6hrs</td><td>250rs</td></tr><tr><td>Female Worker/ Male Worker</td><td>excess of 6hrs</td><td>Excess Rs 200 plus Rs. 1 per min excess of 6hrs</td></tr></table> <p>Apply problem solving framework to read type of the worker and number of hours and print the total amount to be paid by owner</p>	Worker	Hours	Wages	Male Worker	0-6hrs	200rs	Female Worker	0-6hrs	250rs	Female Worker/ Male Worker	excess of 6hrs	Excess Rs 200 plus Rs. 1 per min excess of 6hrs						
Worker	Hours	Wages																	
Male Worker	0-6hrs	200rs																	
Female Worker	0-6hrs	250rs																	
Female Worker/ Male Worker	excess of 6hrs	Excess Rs 200 plus Rs. 1 per min excess of 6hrs																	

9

Under the “CLEAN CITY” project, Bruhat Bengaluru MahanagaraPalike (BBMP) would like to collect the garbage from all parts of the Bangalore city. To manage the garbage better and to ensure cleanliness of the city, the BBMP will send the garbage collection vehicle every day to collect the garbage. BBMP charges a minimal amount for the same from the people as per the table shown below. BBMP planned to collect the amount once in a year.

Type of building	Area in Sq. ft.	Charges in Rs/month
Residential buildings (R)	up to 1000 sqft	10
	1001 sqft to 3000 sqft	30
	Above 3000 sqft	50
Commercial buildings (C)	up to 1000 sqft	50
	1001 sqft to 5000 sqft	100
	Above 5000 sqft	200
Hotels, KalyanaMantapas etc... (O)	up to 10000 sqft	300
	10001 sqft to 50000 sqft	500
	Above 50000 sqft	600

Apply problem solving framework to calculate the total amount to be paid by a person/businessman.

### Iterative Statements

1	<p>Kashmir is surrounded by attackers. A truck enters the city. The driver claims the load is food and medicine from Nepal. Ali is one of the soldiers in Kashmir. He doubts about the truck, maybe it's from the siege. He knows that a tag is valid if the sum of every two consecutive digits of it is even. Determine if the tag of the truck is valid or not.</p> <p><b>Input Format</b></p> <p>The first line contains an integer of length 9. The format is "DDDDD-DD", where D stands for a digit (non zero).</p> <p><b>Output Format</b></p> <p>Print "valid" (without quotes) if the tag is valid, print "invalid" otherwise (without quotes)</p> <p><b>Sample Input</b></p> <p>12345-67</p> <p><b>Sample Output</b></p> <p>invalid</p>
2	<p>You are required to enter a number that consists of x and y that denote the number of 1s and 0s respectively. The input number is considered similar to word 100 if <math>2^x = y</math>.</p>

	<p>Determine if the entered word is similar to word 100.</p> <p>For example, numbers such as 110000 and 111000000 are similar to word 100 but not the words such as 11000 and 11100000.</p> <p>Input format</p> <p>First line: A number that starts with several 1s and continues by several 0s.</p> <p>Note: The maximum length of this number must be 10.</p> <p>Output format</p> <p>Print Yes if the input number can be considered as the 100 otherwise, print No</p>
3	<p>A parking lot in a mall has N number of parking spaces. Each parking space will either be empty(0) or full(1). The status (0/1) of a parking space is represented as an integer consisting of 0's and 1's. The task is to find the number of parking spaces full(1) and empty(0) in the parking lot.</p> <p>Input format:</p> <p>First Line contains T i.e. number of test cases.</p> <p>Next line contains the length of integer N, where <math>1 \leq N \leq 10</math></p> <p>Each of the next N lines contain an integer N containing 1's and 0's</p> <p>Output format :</p> <p>For each test case print the no of free and full status.</p> <p>Sample input:</p> <pre>1 10 0 1 0 1 1 0 1 0 1 1</pre> <p>Sample output:</p> <pre>6 full and 4 free slots</pre>
4	<p>Let us consider the magic of the number 9. An integer n is divisible by 9 if the sum of its digits is divisible by 9.</p> <p>Develop a program to display each digit, starting with the rightmost digit. Your program should also determine whether or not the number is divisible by 9.</p> <p>The input number n is <math>9 \leq n \leq 10000000</math>.</p> <p>Test your program on the following numbers:</p> <pre>n = 154368 n = 621594 n = 123456</pre>
5	<p>At a fun fair, a street vendor is selling different colours of balloons. He sells two different colours of balloons, where 2 and 3 represent red and blue colour balloons. The task is to find the colour of the balloon which is present an odd number of times in the bunch of balloons N, where N is an integer number having 2's and 3's.</p>

	<p>Note: If both coloured balloons are odd in number, then the first colour in the integer N which is present odd number of times is displayed</p> <p>If both the colours are even in number, display the message "All are even"</p> <p>Input format:</p> <p>First Line contains T i.e. number of test cases.</p> <p>Next line contains the length of integer N, where <math>1 \leq N \leq 10</math></p> <p>Each of the next N lines contain an integer N containing 2's and 3's</p> <p>Output format: For each test case print the no of odd coloured balloons.</p> <p>Sample Input:</p> <pre>3 10 222332233 332223 2233</pre> <p>Sample Output:</p> <pre>Red colour balloons are odd in number Blue colour balloons are odd in number All are even</pre>
6	<p>100 Students are waiting in the queue to pay the fees to have lunch in the mess, There are limited seats in the mess, say 80. The mess opens at 1:00pm and closes at 2:00pm, the mess guy takes 80 seconds to process the receipt, at what time (in seconds) does the 50<sup>th</sup> student get his receipt.</p>
7	<p>Each year the Department of Traffic Accidents receives accident count reports from a number of cities and towns across the country. To summarize these reports, the department provides a frequency distribution printout that gives the number of cities reporting accident counts in the following ranges: 0–99, 100–199, 200–299, 300–399, 400–499, and 500 or above. The department needs a computer program to take the number of accidents for each reporting city or town and add one to the count for the appropriate accident range. After all the data have been processed, the resulting frequency counts are to be displayed.</p>
8	<p>Ram and Sham work in a building construction, they have to put some number of bricks N from one place to another, and start doing their work. They decide, they end up with a fun challenge to who will put the last brick. They follow a simple rule, In the i<sup>th</sup> round, Ram puts in bricks whereas Sham puts in <math>i \times 2</math> bricks. There are only N bricks; you need to help find the challenge result to find who put the last brick.</p> <p>Input:</p> <p>First line contains an integer N.</p> <p>Output:</p>

	<p>Output "Ram" (without the quotes) if Ram puts the last bricks ,"Sham"(without the quotes) otherwise.</p> <p>Constraints:  <math>1 \leq N \leq 10000</math></p> <p><b>Sample Input:</b> 13</p> <p><b>Sample Output</b> Sham</p>
9	<p>You have N rectangles. A rectangle is golden if the ratio of its sides is in between [1.6,1.7], both inclusive. Your task is to find the number of golden rectangles.</p> <p><b>Input format</b></p> <p>First line: Integer N denoting the number of rectangles</p> <p>Each of the N following lines: Two integers W,H denoting the width and height of a rectangle</p> <p><b>Output format</b></p> <p>Print the answer in a single line.</p> <p><b>Constraints</b></p> <p><math>1 \leq N \leq 105</math></p> <p><math>1 \leq W, H \leq 109</math></p> <p><b>Sample Input</b></p> <p>5</p> <p>10 1</p> <p>165 100</p> <p>180 100</p> <p>170 100</p> <p>160 100</p> <p><b>Sample Output</b></p> <p>3</p>
10	<p>You have N rectangles. A rectangle is golden if the ratio of its sides is in between [1.6,1.7], both inclusive. Your task is to find the number of golden rectangles.</p> <p><b>Input format</b></p> <p>First line: Integer N denoting the number of rectangles</p> <p>Each of the N following lines: Two integers W,H denoting the width and height of a rectangle</p> <p><b>Output format</b></p> <p>Print the answer in a single line.</p> <p><b>Constraints</b></p>

	$1 \leq N \leq 105$ $1 \leq W, H \leq 109$ <b>Sample Input</b> 5 10 1 165 100 180 100 170 100 160 100 <b>Sample Output</b> 3
<b>Apply Problem Solving Framework and Write a modular C program for all the problems.</b>	
<b><u>1D Arrays</u></b>	
1	<p>A middle class family would always like to spend the money wisely, because of their financial status. They can't afford to purchase luxurious items unlike the Rich Class family. Even if they do, they do it very occasionally. In order to keep track of the expenditure of the entire year, the middle class family maintains a record of how much they spent every month of that year. Assume that for the year 2020, the family maintains a record of expenditure for each month. At the end of the year, the family would like to know the following about their expenditure.</p> <ol style="list-style-type: none"> <li>Which month of the year they spent more (display month number)</li> <li>Which month of the year they spent less (display month number)</li> <li>Which are the months they spent more than 35000 rupees? (display month number)</li> <li>Calculate the average expenditure of the family for the year.</li> </ol> <p><b>Input Format:</b>  Number of months in first line.  Expenditure every month in next line.</p> <p><b>Constraints:</b>  Number of months are fixed to 12.  Starting from 1 to 12, 1 indicates January month, 2 indicates February month and so on up to 12 indicates December month.</p> <p><b>Output Format:</b>  First line should display month number for spent more.  Second line should display month number for spent less.  Third line should indicate month numbers spent more than 35000.</p> <p><b>Sample Input 0:</b></p>

	<p>12 49832 34829 21102 58222 10238 33390 12220 47472 25000 11200 34000 29005</p> <p><b>Sample Output 0:</b></p> <p>4 5 1 4 8</p>										
2	<p>Godrej constructed a new Apartment with N flats, in Hubballi. At the end of each month the Secretary of the apartment collects the maintenance charges based on square feet area of each flat. As per the table given below, help the Secretary to calculate the maintenance charge to be paid by each flat.</p> <table border="1"> <thead> <tr> <th>Area in Square feet</th><th>Charges</th></tr> </thead> <tbody> <tr> <td>501-800</td><td>2 Rs/sq. feet</td></tr> <tr> <td>801-1000</td><td>5Rs/sq. feet, for above 800 sq. feets.</td></tr> <tr> <td>1001-1500</td><td>7Rs/ sq. feet, for above 1000 sq. feets.</td></tr> <tr> <td>Above 1500</td><td>8Rs/ sq. feet, for above 1500 sq. feets.</td></tr> </tbody> </table> <p><b>Input Format:</b> Number of flats in Apartment. Area of Each flat.</p> <p><b>Constraints:</b> Flat area should be considered in square feet.</p> <p><b>Output Format:</b> First line is flat number. Second line is area of flat. Third line is Maintenance charge of each flat.</p> <p><b>Sample Input 0:</b></p> <p>5 600 750 1200 1650 1900</p> <p><b>Sample Output 0:</b></p> <p>1 2 3 4 5 600 750 1200 1650 1900 1200 1500 4000 7300 9300</p>	Area in Square feet	Charges	501-800	2 Rs/sq. feet	801-1000	5Rs/sq. feet, for above 800 sq. feets.	1001-1500	7Rs/ sq. feet, for above 1000 sq. feets.	Above 1500	8Rs/ sq. feet, for above 1500 sq. feets.
Area in Square feet	Charges										
501-800	2 Rs/sq. feet										
801-1000	5Rs/sq. feet, for above 800 sq. feets.										
1001-1500	7Rs/ sq. feet, for above 1000 sq. feets.										
Above 1500	8Rs/ sq. feet, for above 1500 sq. feets.										
3	<p>KLE Technological University is a well-known University for its academic excellence and Innovations. Top ranked students, always prefer the University for their</p>										



	<p>Graduation in BE. Assume that for the year 2021-22, there are N students admitted to the university for the 1st year. Help University to perform the following tasks:</p> <ol style="list-style-type: none"> <li>Read the rankings of N students.</li> <li>Arrange the rankings in ascending order.</li> <li>Display the highest and lowest rank among all the students' ranks.</li> </ol> <p><b>Input format:</b> First line is number of students. Second line is Rank of each student.</p> <p><b>Constraints:</b> <math>1 \leq \text{Rank} \leq 100000</math></p> <p><b>Output format:</b> First line is ascending order of ranks. Second line is highest rank. Third line is lowest rank.</p> <p><b>Sample Input 0:</b> 9 234 120 13334 84919 6432 1827 2337 19283 55321</p> <p><b>Sample Output 0:</b> 120 234 1827 2337 6432 13334 19283 55321 84919 84919 120</p>
4	<p>A nursery kid playing a game with a list of N numbers, each number is of minimum 3 digits. At the beginning, the kid reads individual numbers from left to right and counts the total numbers. Next the kid has to rearrange the individual numbers from the list so that the first and last digit of a number should be swapped. If after swapping the numbers remain the same, then such numbers should be removed from the set and count the remaining numbers from the list. Apply a problem solving framework to solve the kid's problem.</p> <p><b>Input format:</b> Input numbers. Press 0 to stop the input.</p> <p><b>Constraints:</b> Each number should be positive and 3 digits only.</p> <p><b>Output format:</b> First line is count of numbers. Second line is numbers after swapping first and last digit. Third line is remaining numbers after deletion.</p>

	<p>Fourth line is count of remaining numbers.</p> <p><b>Sample input 0:</b> 234 915 883 121 949 831 747 595 0</p> <p><b>Sample output 0:</b> 8 432 519 388 121 949 138 747 595 432 519 388 138 4</p>
5	<p>The explosive growth of Internet communications and data storage on Internet-connected computers has greatly increased privacy concerns. The field of cryptography is concerned with coding data to make it difficult (and hopefully—with the most advanced schemes—impossible) for unauthorized users to read. In this exercise you'll investigate a simple scheme for encrypting and decrypting data. A company that wants to send data over the Internet has asked you to write a program that will encrypt it so that it may be transmitted more securely. All the data is transmitted as four-digit integers. Your application should read a four-digit integer entered by the user and encrypt it as follows: Replace each digit with the result of adding 7 to the digit and getting the remainder after dividing the new value by 10. Then swap the first digit with the third, and swap the second digit with the fourth. Then print the encrypted integer. Write a separate application that inputs an encrypted four-digit integer.</p> <p><b>Input Format:</b> A number.</p> <p><b>Constraints:</b> <math>1111 \leq \text{number} \leq 9999</math></p> <p><b>Output Format:</b> Encrypted number.</p> <p><b>Sample Input 0:</b> 4793</p> <p><b>Sample Output 0:</b> 6014</p> <p><b>Explanation:</b> Step 1: Separate each digit from the number and add 7 to each digit.  <math display="block">\begin{array}{r} 4\ 7\ 9\ 3 \\ +\ 7\ 7\ 7\ 7 \\ \hline =\ 11\ 14\ 16\ 10 \end{array}</math> Step 2: Apply modulus 10 to each resultant digit to obtain remainder.  1 4 6 0</p>

	<p>Step 3: Swap first and third digit. 6 4 1 0</p> <p>Step 4: Swap second and fourth digit. 6 0 1 4</p> <p>Step 5: Combine all the digits and display single number as encrypted number. 6014</p>
6	<p>Rajesh was playing an array game for the very first time. He has a set of numbers which are both positive and negative. He wants to know if he adds some of the numbers or all the numbers may obtain a sum as 0. Help Rajesh to find whether such a set of numbers exists.</p> <p>Ex: If A= {-4, 3, 1, 5, -5}      output: Exist. If A= {1,2,3}      output: Does not exist.</p> <p><b>Input format:</b> First line indicates N numbers. Second line is numbers.</p> <p><b>Constraints:</b> Numbers are both positive and negative.</p> <p><b>Output format:</b> Numbers Exist or Numbers does not exist.</p> <p><b>Sample Input 0:</b> 5 -4 3 1 5 -5</p> <p><b>Sample Output 0:</b> Exist</p> <p><b>Sample Input 1:</b> 3 1 2 3</p> <p><b>Sample Output 1:</b> Does Not Exist</p>
7	<p>In an old Bombay a business man imports and exports merchandise which are valuable and worth in Crores. He maintains a separate bag for every day's unique collection. One day, a person X files complaint at a police station that his valuable item worth of Z Crores has been stolen and shares the image of the item. Now police have doubt on business man and start searching the bags by comparing the image of the item with the actual item. Implement the above scenario by applying a problem solving framework to find whether a business man is guilty.</p> <p><b>Input format:</b></p>

	<p>Number of days of collection (N). Worth of each day's item. Worth of item stolen (Z). <b>Constraints:</b> Item's worth in Crores. <b>Output format:</b> Business man guilty if the item is found, otherwise Not guilty. <b>Sample input 0:</b> 9 2.64 5.92 8.23 2.56 4.22 10.45 4.55 1.78 4.5 10.45 <b>Sample output 0:</b> Business man is guilty.</p>
8	<p>There are N buildings, whose height in feet is given. All buildings are in the same line. Mohan is standing at the left most side of all the buildings. Due to the difference in heights of buildings, Mohan can see only a few buildings. Given the heights of all buildings, let Mohan know which all buildings can he see with their corresponding heights. <b>Input format:</b> Number of buildings (N). Height of buildings. Height of the position where Mohan is standing at left side of buildings. <b>Constraints:</b> 50 &lt;= Buildings height in feet &lt;= 500. <b>Output format:</b> Height of all the buildings which Mohan can see. <b>Sample input 0:</b> 5 150 100 75 250 190 200 <b>Sample output 0:</b> 150 250</p>
9	<p>You are in charge of the cake for your brother's birthday and have decided the cake will have one candle for each year of his total age. When he blows out the candles, he'll only be able to blow out the tallest ones. Your task is to find out how many candles he can successfully blow out. Apply Problem Solving Framework and solve using circular doubly linked list.</p>

	<p>For example, if your brother is turning 5 years old, and the cake will have 5 candles of height 7, 6, 4, 7, 3, he will be able to blow out 2 candles successfully, since the tallest candles are of height 7 and there are 2 such candles.</p> <p><b>Input Format:</b> Read N - number of candles. Read height of each candle.</p> <p><b>Constraints:</b> N should be positive. height of candles should be stored in one dimensional array.</p> <p><b>Output Format:</b> Height of all candles. Tallest candle. Count of tallest candles blown.</p> <p><b>Sample Input 0:</b> 5 7 6 4 7 3</p> <p><b>Sample Output 0:</b> 7 6 4 7 3 Tallest Candle = 7 Tallest Candles blown = 2</p>
10	<p>You are given an integer 'n' which denotes the number of elements in an array a [] and an integer 'x'. You have to calculate the average of element a[i] and x, then find out if that number exists in the array. Perform the operation for all the elements of array and store the count in another array for each index i.</p> <p><b>Input format:</b> First line is N – total numbers in array. Second line is all the input numbers. Third line is X – an integer.</p> <p><b>Constraints:</b> 0&lt;=numbers in array and X &lt;= 100</p> <p><b>Output format:</b> Count of each number existing in array.</p> <p><b>Sample input 0:</b> 6 41 29 84 10 85 33 25</p> <p><b>Sample output 0:</b></p>

	1 0 0 0 0 1
2D ARRAYS.	
1	<p>King Monty School has 4 divisions A, B, C and D in the 5th standard. There are an equal number of students in each division. Due to the shift from online mode of classes to offline mode, the performance of students is decreasing day by day. The principal instructed teachers to conduct a test at the end of every month and report the performance of students. In the month of February, the first test was conducted across all 4 divisions. Each student has to attempt the test for 25 points. After the test was completed, the principal instructed teachers of respective divisions to calculate average points of each division and report the lowest division. Apply problem solving framework and write modular c program to help the Principal.</p> <p><b>Input Format:</b> First line is M – indicates number of divisions. N – indicates the number of students in each division. Second line onwards is the points of each student in each division.</p> <p><b>Constraints:</b> M and N &gt; 0. 0 &lt;=points &lt;= 25.</p> <p><b>Output Format:</b> Division with lowest average points.</p> <p><b>Sample input 0:</b></p> <pre>4 10 24 21 12 4 23 12 13 24 9 15 25 20 19 15 6 7 12 17 10 17 19 10 17 16 20 15 19 10 0 25 10 10 5 7 9 18 16 18 0 0</pre> <p><b>Sample Output 0:</b></p> <p>Division with lowest average points is D.</p> <p><b>Sample input 1:</b></p> <pre>4 10 15 15 24 8 4 23 4 0 9 25 20 22 25 24 20 17 19 5 4 0 19 13 10 15 25 10 25 18 19 10 15 12 15 20 23 22 22 21 20 24</pre> <p><b>Sample Output 1:</b></p> <p>Division with lowest average points is A.</p>
2	<p>Rakesh is an expert in solving matrix problems. He challenges Rajesh to perform the following task on an array to interchange elements of primary (major) diagonal with secondary (minor) diagonal. Rajesh was clueless to solve the problem. He asked for help from one of the first year students who are studying the C programming for Problem Solving course. The student clarified Rajesh's doubt by</p>

	<p>discussing the following example:</p> <p>Input matrix elements:</p> <p>1 2 3</p> <p>4 5 6</p> <p>7 8 9</p> <p>Matrix after interchanging its diagonal:</p> <p>3 2 1</p> <p>4 5 6</p> <p>9 8 7</p> <p>Help Rajesh to perform the task by applying problem solving framework.</p>																														
3	<p>Apply problem solving framework to perform rotating of a n x n two dimensional array by 90 degrees clockwise. It can be assumed that <math>n=2^k</math> for some positive integer k.</p> <p><b>Sample input 0:</b></p> <p>1 2 3 4</p> <p>5 6 7 8</p> <p>9 10 11 12</p> <p>13 14 15 16</p> <p><b>Sample output 0:</b></p> <p>13 9 5 1</p> <p>14 10 6 2</p> <p>15 11 7 3</p> <p>16 12 8 4</p>																														
4	<p>An election is contested by 5 candidates. The candidates are numbered 1 to 5 and the voting is conducted by marking the candidate's number on the ballot paper. Apply Problem solving framework and Write a modular C program to read the ballots and count the vote cast for each candidate.</p> <table><tr><th>Candida te</th><th>Voter 1</th><th>Voter 2</th><th>Voter 3</th><th>Voter 4</th></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td></tr><tr><td>3</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>4</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>5</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table> <p><b>Input Format:</b></p> <p>First line indicates number of Candidates.</p>	Candida te	Voter 1	Voter 2	Voter 3	Voter 4	1	1	1	0	0	2	0	0	0	0	3	0	0	1	0	4	0	0	0	1	5	0	0	0	0
Candida te	Voter 1	Voter 2	Voter 3	Voter 4																											
1	1	1	0	0																											
2	0	0	0	0																											
3	0	0	1	0																											
4	0	0	0	1																											
5	0	0	0	0																											

	<p>Second line indicates the number of voters. Further lines indicate the matrix of votes casted by voters.</p> <p><b>Constraints:</b> Vote can be either 0 or 1 by a voter. 1 indicates a voter casted a vote to one candidate only. For other candidates' vote becomes 0.</p> <p>Output Format: Display candidate wise vote count.</p> <p><b>Sample input 0:</b></p> <pre>5 4 1 1 0 0 0 0 0 0 0 0 1 0 0 0 0 1 0 0 0 0</pre> <p><b>Sample output 0:</b></p> <pre>Candidate 1: 2 Candidate 2: 0 Candidate 3: 1 Candidate 4: 1 Candidate 5: 0</pre>
5	<p>Rinku was reading a newspaper one-day morning. She came across a Sudoku game where she tried to solve it in a different way. For a N x N Sudoku game, she adds up all the column wise numbers. If all the column wise sums are equal, then she called it a Rinku's Sudoku square. Apply a problem solving framework and write a modular C program to identify whether the square is Rinku's Sudoku square.</p> <p><b>Input format:</b> N – indicates Size of Sudoku square.</p> <p><b>Constraints:</b> Rows and columns should be equal.</p> <p><b>Output format:</b> Display a message whether Sudoku square is Rinku's Sudoku square.</p> <p><b>Sample input 0:</b></p> <pre>4 4 3 6 5 8 7 2 1 5 6 3 4</pre>



	<p>1 2 7 8</p> <p><b>Sample output 0:</b></p> <p>Sudoku square is Rinku's Sudoku square.</p>
6	<p>Zanfi Systems is a software development Multi National Company. It has offices in different countries. Due to Lockdown and slow work progress, the company had deducted 30% salary for all the employees. Considering there are N employees in M offices, based on actual salary, the lockdown salary of each employee after deduction is computed by the Human Resource Manager. Apply problem solving framework and write a modular C program to determine the lockdown salary.</p> <p><b>Input format:</b></p> <p>First line is M – indicates the number of offices and N – indicates number of employees.</p> <p>Second line onwards is the salary of every employee in all the offices.</p> <p><b>Constraints:</b></p> <p>10000 &lt;= salary &lt;= 100000</p> <p><b>Output format:</b></p> <p>Salary of every employee after deduction.</p> <p><b>Sample input 0:</b></p> <p>2 5</p> <p>35500 42000 33000 55000 62000</p> <p>45000 23000 22000 12000 59000</p> <p><b>Sample Output 0:</b></p> <p>Salary after deduction:</p> <p>24850 29400 23100 38500 43400</p> <p>31500 16100 15400 8400 41300</p>
7	<p>Bharat Aircrew Ltd., decided to provide bonus for employees for the Quarter 2 (6 months) of 2018-19 based on sales of 4G connections to new customers. If the total sales of new 4G connections exceed 4lacs for Quarter 2, an employee gets bonus of 2% for his salary. If total sales exceed 5lacs, 4% of bonus, if sales exceeds 6lacs, 6% of bonus. Consider Employees belong to same department and has equal experience. Therefore, salary of all employees is 25000/month. Bonus is provided once in a quarter based on salary. The sales details are provided as follows for 5 employees. Sales are in terms of Lacs per month.</p> <p><b>Input Format</b></p> <p>First line indicates number of employees. Second line indicates the number of months in Quarter 2. Further lines indicate matrix of sales of new 4G connections per month.</p> <p><b>Constraints</b></p>

	<p>Sales are in terms of lacs.</p> <p><b>Output Format</b></p> <p>Display bonus for each employee.</p>
8	<p>Shankar and sundar are playing with a cube. After certain period of time kashi came and she wants to check whether they have same elements on the cube. Help kashi to compare two cubes and tell whether two cubes are equal or not.</p> <p><b>Input Format:</b></p> <p>The first line contains a single integer, n, the number of rows and columns in the matrix arr1 and arr2. Each of the next n lines describes a row, arr[i], and consists of n space-separated integers arr[i][j].</p> <p><b>Constraints:</b></p> <p><math>0 \leq \text{arr}[i][j] \leq 100</math></p> <p><b>Output Format:</b></p> <p>Print the two matrices are equal or not.</p> <p>Sample Input 0:</p> <pre>2 1 2 4 3  7 8 6 5</pre> <p><b>Sample Output 0:</b></p> <p>Not equal</p> <p><b>Sample Input 1:</b></p> <pre>3 1 1 1 1 1 1 1 1 1  1 1 1 1 1 1 1 1 1</pre> <p><b>Sample Output 1:</b></p> <p>Equal</p>
9	<p>Indian Cricket team is at its peak in International Cricket Ratings from past 5 years. Several of its players appeared in world top 10 rankings in both bowling and batting. Considering N number of batsmen of Indian Cricket team and considering</p>

<

	<table><tr><td>staplers</td><td></td><td></td><td>6</td></tr></table> <p>Find the average sales for each colour and type of stapler in the 2-months duration.</p>	staplers			6
staplers			6		
<b>Strings</b>					
1	<p>The Caesar cipher is a type of substitution cipher in which each alphabet in the plaintext or messages is shifted by a number of places down the alphabet. For example, with a shift of 1, P would be replaced by Q, Q would become R, and so on. To pass an encrypted message from one person to another, it is first necessary that both parties have the 'Key' for the cipher, so that the sender may encrypt and the receiver may decrypt it. Key is the number of OFFSET to shift the cipher alphabet. Key can have basic shifts from 1 to 25 positions as there are 26 total alphabets. As we are designing a custom Caesar Cipher, in addition to alphabets, we are considering numeric digits from 0 to 9. Digits can also be shifted by key places. For Example, if a given plain text contains any digit with values 5 and key=2, then 5 will be replaced by 7, "-"(minus sign) will remain as it is. Key value less than 0 should result into "INVALID INPUT"</p> <p>Example 1: Enter your Plaintext: All the best Enter the Key: 1 The encrypted Text is: Bmm uif Cftu</p> <p>Write a function CustomCaesarCipher(int key, String message) which will accept plaintext and key as input parameters and returns its cipher text as output.</p>				
2	<p>FULLY AUTOMATIC VENDING MACHINE – dispenses your cuppa on just press of button. A vending machine can serve range of products as follows:</p> <p>coffee</p> <ol style="list-style-type: none"><li>1.Espresso Coffee</li><li>2.Cappuccino Coffee</li><li>3.Latte Coffee</li></ol> <p>tea</p> <ol style="list-style-type: none"><li>1.Plain Tea</li><li>2.Assam Tea</li><li>3.Ginger Tea</li><li>4.Cardamom Tea</li><li>5.Masala Tea</li><li>6.Lemon Tea</li><li>7.Green Tea</li><li>8.Organic Darjeeling Tea</li></ol>				

	<p>Write a program to take input for main menu(coffee c and tea t) &amp; sub menu(enter number) and display the name of sub menu selected in the following format (enter the first letter to select main menu):</p> <p>Welcome to CCD</p> <p>Enjoy your</p> <p>Example 1:</p> <p><b>Input:</b></p> <p>c</p> <p>1</p> <p><b>Output</b></p> <p>Welcome to CCD!</p> <p>Enjoy your Espresso Coffee!</p> <p>Example 2:</p> <p><b>Input</b></p> <p>t</p> <p>9</p> <p><b>Output</b></p> <p>INVALID OUTPUT!</p>
3	<p>Write a modular C program(without using built-in functions) which accepts first name, middle name and last name in three separate strings and generates full name as one string and short name as another string. Ex: if first_name ="Mohandas" middle_name="Karamchand" last_name="Gandhi", then the full_name=" Mohandas Karamchand Gandhi" short_name = "MKG"</p>
4	<p>Given a string S and two integers L and R. Print the characters in the range L to R of the string.</p> <p>NOTE: Assume zero based indexing.</p> <p>Input: First line of input contains a single integer T which denotes the number of test cases.</p> <p>T test cases follows,</p> <p>first line of each test case contains a string S.</p> <p>Second line consists of two integers L and R. Output: Corresponding to each test case, print the required output.</p> <p>Constraints: <math>1 \leq T \leq 100</math> <math>1 \leq \text{length}(S) \leq 1000</math></p> <p><math>1 \leq L \leq R</math></p> <p>Example:</p> <p><b>Input:</b></p> <p>2</p>

	<p>Cdbkdub 0 5 Sdiblcdbud 3 7 <b>Output:</b> cdbkdu blcsd</p>
5	<p>Shashank likes strings in which consecutive characters are different. For example, he likes ABABA, while he doesn't like ABAA. Given a string containing characters A and B only, he wants to change it into a string he likes. To do this, he is allowed to delete the characters in the string. Your task is to find the minimum number of required deletions.</p> <p><b>Input Format</b> The first line contains an integer T i.e. the number of test cases. Next T lines contain a string each.</p> <p><b>Output Format</b> Print minimum number of required steps for each test case.</p> <p><b>Constraints</b> <math>1 \leq T \leq 10</math> <math>1 \leq \text{length of String} \leq 105</math></p> <p><b>Sample Input</b> 5 AAAA BBBBB ABABABAB BABABA AAABBB</p> <p><b>Sample Output</b> 3 4 0 0 4 Explanation AAAA-&gt;A, 3 deletions BBBBB-&gt;B, 4 deletions ABABABAB-&gt;ABABABAB, 0 deletions BABABA-&gt;BABABA, 0 deletions</p>

	AAABBB->AB, 4 deletions
6	Seeta and Geeta were writing an article on women's empowerment. They want to know if they both have used the same characters (only alphabets ignoring case) the same number of times. Write a modular program which reads text of both Seeta and Geeta and help them to know if they have used the same characters the same number of times.
7	Write a program that extracts part of a given string from a specified position. For example if the string is "working with string is fun", then if from position 3, 4 characters are to be extracted then the program should return the string as "king". If the number of characters to be extracted is 0 then the program should extract the entire string from the specified position.
<b>Pointers</b>	
1	On the celebration of children's day, class CR has organized game for his classmates. Students are divided into teams. Team1 has to give question to team2. Members of Team2 are Sudha and Ram have got task from team1. The task is to combine the words in meaning full manner and put it in the box. The word received by Sudha is "CET" and ram has got "BVB". Help team2 members to complete the task using pointers.
2	In a college there is a competition on the eve of Teachers day. One team must include two members. The task given to the team is to exchange two numbers given to them. Help the teachers to solve the above task using pointers.
3	Shyam is attending an interview at TCS company. He has cleared first round of aptitude test. Second round is coding test where he has been given a snippet of code. The code includes some errors, help Shyam to rectify the errors and complete the code.  <pre>#include &lt;stdio.h&gt; int main() { int x[10]={0,1,2,3,4,5,6,7,8,9}; int *ptr1,*ptr2; ptr1=&amp;x[0]; ptr2=&amp;x[5]; printf("%p\n",(ptr1+ptr2)); return 0; }</pre>
4	Adobe is playing an array game. He is weak in the concepts of arrays. Adobe is given two arrays a[ ] and b[ ] of the same size. The array a[ ] will be said to fit in array b[ ] if by arranging the elements of both array, there exists a solution such that i_th element of a[ ] is less than or equal to an i_th element of b[ ]. Help Adobe find if the given

	<p>arrays are fit or not. Apply pointer to array.</p> <p>Example:</p> <p><b>Input</b></p> <p>2</p> <p>4</p> <p>7 5 3 2</p> <p>5 4 8 7</p> <p>8</p> <p>7 5 3 2 5 105 45 10</p> <p>2 4 0 5 6 9 75 84</p> <p><b>Output</b></p> <p>YES</p> <p>NO</p>
5	<p>Write a modular C program using pointers which accepts first name, middle name and last name in three separate strings and generates full name as one string and short name as another string. Ex: if first_name = "Mohandas" middle_name="Karamchand" last_name="Gandhi", then the full_name=" Mohandas Karamchand Gandhi" short_name = "MKG"</p>
6	<p>What is the output of following program?</p> <pre>int main() {int *ptr;   int x;   ptr = &amp;x;   *ptr = 0;   printf(" x = %d\n", x); printf(" *ptr = %d\n", *ptr);   *ptr += 5;   printf(" x = %d\n", x); printf(" *ptr = %d\n", *ptr);   (*ptr)++;   printf(" x = %d\n", x); printf(" *ptr = %d\n", *ptr);   return 0; }</pre>
7	<p>Akash is a small kid who used to play with Magnetic Alphabet and numbers. After so many days he is going to school. On the first day of his school the Teacher asked him to participate in the Pleiades event. There were many games conducted in the event. He chose a game called "count and win". There are 2 tasks in a game, the first task is to count and display the alphabets, the second task is to count and display the digits in ascending order, from the box consisting of Magnetic Alphabets and numbers. Help</p>



	<p>Akash to win the game by writing a c program using pointers.</p> <p><b>Input:</b> ABC254HT</p> <p><b>Output:</b></p> <p>No. of alphabets: 5</p> <p>ABCHT</p> <p>No. of digits: 3</p> <p>245</p>
8	<p>There are 5 buildings, which is built by a boy named Kartik using building blocks, whose height is in meters. All buildings are in same line. Kartik is standing at the right most side of all buildings. Due to difference in heights of buildings, Kartik can see only few buildings. Help Kartik to arrange building blocks so that he can see all the buildings. Solve the above scenario using pointers.</p>
9	<p>In a Kindergarten admission has started, the class teacher has to prepare the list of students admitted. The list has to be prepared in an alphabetical order. Help the class teacher to prepare the list using pointers and functions.</p> <p>Input: Kavya Shreehari Anil</p> <p>Output: Anil Kavya Shreehari</p>
10	<p>Write a modular C program using pointers which accepts character string and a character as argument and deletes all occurrences of this character in the string. The function should return the corrected string with no holes.</p>
<b>Structures</b>	
1	<p>Define a structure called cricket that will describe the following information: Player name, Team name, Batting average. Using cricket, declare an array player with 50 elements and write a program to read the information about all the 50 players and print a team wise list containing names of players with their batting average.</p>
2	<p>Define a structure data type called time_struct containing three members integer hour, integer minute and integer second. Develop a program that would assign values to the individual members and display the time in the following format: 16:04:51</p>
3	<p>Assume that you run a restaurant and keep a computerized data of all the customers visiting the restaurant. Write a modular C program and write routines for the following:</p> <p>i) Find the total bill at the end of the day</p> <p>ii) Sort the customer such that the customer with minimum bill is displayed first.</p>

	iii)Delete the food record which is ordered less by the customer
4	<p>Vishal owns a cyber café, where he has 'n' number of computers. Since Vishal is lazy to write the details of 'n' computers in paper, he stores the details of computers using c programming.</p> <p>Please help Vishal to store the details of computers and perform the below operations.</p> <p>a) Sort and Display the computers based on RAM capacity.</p> <p>b) Display only "HP" computers.</p>
5	<p>Blockchain is the new technology in computer science, where it is used to store the 'n' Transaction details of users. Shivam is very much interested in implementing blockchain kind of technology using C programming. Transaction details contains: Transaction_ID, sender, receiver, amount, time.</p> <p>Please help Shivam to implement the above problem and perform the below operations.</p> <p>a) Display the transaction details of particular Transaction_ID.</p> <p>b) Display the transaction details of particular user.</p>
6	<p>Radio mirchi " Hubli have organized a context on 6/9/2019. People who have participated in the Context is given some points, depending on their answers. Manager of Radio mirchi is a peculiar Person, He announces two winners.</p> <p>i) First winner- one who has got second highest points.</p> <p>ii) Second winner- one who has got least points.</p> <p>Note: points are non-negative and assuming more than 6 people have participated in context.</p> <p>Please help Manager VK to announce the winners</p>
7	<p>Create a structure to specify data of customers in a bank. The data to be stored is: Account number, Name, Balance in account. Assume maximum of 200 customers in the bank.</p> <p>(a) Write a function to print the Account number and name of each customer with balance below Rs. 100.</p> <p>(b) If a customer request for withdrawal or deposit, it is given in the form: Acct. no, amount, code (1 for deposit, 0 for withdrawal) Write a program to give a message, "The Balance is insufficient for the specified withdrawal".</p>
8	<p>An automobile company has serial number for engine parts starting from AA0 to FF9. The other characteristics of parts to be specified in a structure are: Year of manufacture, material and quantity manufactured.</p> <p>(a) Specify a structure to store information corresponding to a part.</p> <p>Write a program to retrieve information on parts with serial numbers between BB1 and CC6.</p>

---

9	A record contains name of cricketer, his age, and number of test matches that he has played and the average runs that he has scored in each test match. Create an array of structure to hold records of 20 such cricketer and then write a program to read these records and arrange them in ascending order by average runs.
10	Write a modular C program to define a structure called PHONEBOOK with suitable fields. Write C functions to do the following: i) Search for a person by phone number. ii) Update the address of a particular person. Display the details of a person by giving his address.