

Practice Problems

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if-else, switch

- 1 Write a C code to show the result of a student as follows. It takes as input marks of 5 subjects. If the student gets less than 30 in one subject, then print “Backlog”; if less than 30 in two or more subjects, then print “Fail”. For pass in all subjects (marks ≥ 30 in each), show the percentage.

Input: 30,40,90,20,10. Output: Fail.
Input: 30,40,90,20,80. Output: Backlog.
Input: 30,40,90,40,80. Output: 56%.

- 2 Write a C code to check whether the roots of a quadratic equation are equal. If equal, then print whether the root is positive or not. For unequal roots, write the largest root and its difference with the smallest.

Input: a=1, b=4, c= 4. Output: Equal, positive.
Input: a=1, b=1; c=-2. Output: largest root = 2, difference = 3.

- 3 Suppose the government takes 5% income tax for annual income exceeding Rs. 5 lakh, 10% for income exceeding 10 lakh (along with 5% tax up to annual income of 10 lakh) and no tax for less than 5 lakh. Write a code that will take input income and will output net income after deducting income tax.

Input: 400000. Output: net income = 400000.
Input: 600000. Output: net income = 600000 - 5000 = 595000.

- 4 Write a program that takes as input the monthly income of a person and prints the following.

For monthly income within 20,000, write “poor”; for 20,000 to 40,000, write “middle class”, else mention “rich”. Use switch-case statements.

Input: 30000. Output: middle class
Input: 40500. Output: rich

- 5 Suppose in this covid-19 pandemic, govt. provides relief fund to each family. If a family has 3 or less members, then it provides Rs. 3000 per member of the family. If the family has 3 to 6 members, then it provides relief as Rs. 2,500 per member. For more than 6 members, it gives an amount of 16,000 to the family.

Write a C code using switch-case statements that will take as input the number of family members and will output the relief fund they get. Try to optimize the use of switch-case statements.

```
Input: 3. Output: 3 × 3000 = 9000
Input: 5. Output: 5 × 2500 = 12500
Input: 10. Output: 16000
```

Loops

- 1 Find the sum of product of every two consecutive factors for a given integer. Only the distinct factors should be considered.

```
Input: 42. Output: 2.3+3.7 = 27
Input: 84. Output: 2.3+3.7 = 27
```

- 2 Write a program that takes n integer inputs and finds the sum of all the numbers after the first two consecutive even numbers. Assume that the user always gives at least two consecutive even numbers.

```
Input: n=5; 11, 8, 13, 16, 18, 23, 79, 1. Output: 23+79+1=103
Input: n=5; 11, 8, 13, 16, 18, 20, 79, 1. Output: 20+79+1=100
```

- 3 Write a program which takes n integer inputs and find the sum of their last digits and the sum of their second-last digits.

```
Input: n=3; 42, 567, 34567.
Output: sum of last =3+2+7+7=19; sum of second last =4+6+6=16.
```

- 4 Write program to find the smallest factor of a given integer using for loop.
Do the same using while loop.
Do the same with do-while loop.

```
Input: 15. Output: 3.
```

- 5 Find the sum of n positive integers, with the i -th number raised to the i -th power of. Do not use math.h.

Input: $n = 3$; 1, 4, 5. Output: $1+16+125=142$

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1D Array

1. Write a program to find the mode (element with maximum occurrence) in a sorted (in increasing order) array. If there is more than one mode, then print the largest one.

Input: 2, 2, 2, 4, 4, 7, 7, 7, 7, 8, 14, 14.

Output: 7

Input: 2, 2, 2, 4, 7, 7, 7, 7, 8, 14, 14, 14, 14, 15, 15.

Output: 14

2. Write a program to put an element x in a proper place of a sorted (in increasing order) array. Assume that the array that contains distinct elements and x is also different from the existing elements in the array.

Input: 2, 3, 5, 6, 7; $x = 4$. Output: 2, 3, 4, 5, 6, 7.

Input: 1, 8, 12, 17; $x = 5$. Output: 1, 5, 8, 12, 17.

3. Write a program to find the frequencies f of all elements in a sorted array.

Input: 2, 2, 2, 4, 7, 7, 7, 7, 8, 14, 14.

Output: $f = 3, 1, 4, 1, 2$.

4. Write a program to find the third smallest in a sorted array.

Input: 2, 2, 2, 4, 4, 7, 7, 7, 7, 8, 14, 14. Output: 7.

Function

1. Write a program to rotate a number towards left by one digit (using function).

Input: 1467. Output: 4671.

Input: 31456. Output: 14563.

2. Write a function `n_choose_r(int n, int r)` to compute $\binom{n}{r}$ with integers n and r as input parameters. Call this function from `main()` to print the values of $\binom{n}{0}, \binom{n}{1}, \dots, \binom{n}{n}$, with n varying from 1 up to a user-specified value. Hint: Use two “for loops” suitably in `main()`.

Input: `n = 5.`

Output:

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

3. Define a function that takes as input three vertices of a triangle and returns its area. Use this function to find the area of quadrilateral.

Input: `(0,0), (3,0), (4,0), (3,4).` Output: 12.

Recursion

1. Write a recursive function to implement *Ackermann function* $f(m, n)$ as defined below.

$$A(0, n) = n + 1,$$

$$A(m, 0) = A(m - 1, 1),$$

$$A(m, n) = A(m - 1, A(m, n - 1)) \quad \forall m, n > 0.$$

For user-specified values of m and n , call it from `main()` to print the value of $A(m, n)$.

Input: `m = 0, n = 4.` Output: 5.

Input: `m = 1, n = 2.` Output: 4.

Input: `m = 3, n = 1.` Output: 13.

2. Write a recursive function to implement *Legendre polynomial* as defined below.

$$P_0(x) = 1,$$

$$P_1(x) = x,$$

$$P_n(x) = \left(\frac{2n-1}{n}\right)x P_{n-1}(x) - \left(\frac{n-1}{n}\right)P_{n-2}(x), \quad \forall n \geq 2.$$

For user-specified values of n and x , call it from `main()` to print the value of $P_n(x)$.

Input: `n=1, x=2.` Output: 2

Input: $n=2$, $x=3$. Output: 13