Section 1– CS MCQ

1. Graph
Definitions:
A connected graph is a graph where each node has a path to another.
An un-directed graph is a graph in which edges have no orientation.
The degree of a node is the number of edges that connect to it.

We want to construct a connected un-directed graph which can have only a unique edge between any two nodes, without any self-edges and where the degrees of the nodes are: 1, 2, 2, 2, 4, 4, 7

Which of the following statement is true for this graph?
  a. These nodes are sufficient to make a graph
  b. There is one missing node and it's degree can be 4
  c. There is one missing node and it's degree can be 5
  d. None of the above three statements is true

2. Recursion

Let $A(n) = A(n-1) + 2*A(n-2) + 2$
$A(0) = 1$, $A(1) = 0$.

The value of $A(15)$ will be

  a. 32766
  b. 16383
  c. 65532
  d. 32761

3. The instructions of a simplified computer, which has only two registers R1 and R2, are given below

OP Ri, Rj - Performs Ri OP Rj and stores the result in register Rj.
OP m, Ri - Performs (the content of memory location m) OP Ri and stores the result in Ri
MOV m, Ri - Moves the content of memory location m to register Ri.
MOV Ri, m - Moves the content of register Ri to memory location m.
OP is either ADD or SUB.

We have the following basic block:

T1 = a + b
T2 = c + d
T3 = e - T2
f = T1 - T3

Assuming that all operands (a, b, c, d, e) are initially in memory and the final value (f) of the computation in memory, the minimum number of MOV instructions in the code generated for this basic block is:

  a. 2
  b. 3
  c. 6
  d. 4

4. Consider the following pseudo code. What is the total number of multiplications to be performed?

D = 2

for i = 1 to n do

for j = i to n do

   for k = j + 1 to n do

      D = D * 3

    a. Half of the product of 3 consecutive integers
    b. One-third of the product of 3 consecutive integers
    c. One-sixth of the product of 3 consecutive integers
    d. Product of 3 consecutive integers

5. What is the minimum number of arithmetic operations required to evaluate the polynomial $P(X) = X^6 + 3X^3 + 9X + 5$ for a given value of X using only one temporary variable, in which the result is also to be stored?

    a. 6
    b. 7
    c. 8
    d. 9

6. What will be the average time complexity of quick sort over arrays of size n where, always the first element is taken as pivot?

    1. O(n log n) for all arrays of size n, O(n) for already sorted array of size n
    2. O(n log n) for all arrays of size n, O(n log n) for already sorted array of size n
    3. O(n) for all arrays of size n, O(n) for already sorted array of size n
    4. O(n) for all arrays of size n, O(n log n) for already sorted array of size n

Section 2 – CS Coding

1. String permutations
Write a program to print all permutations of a given string.
A permutation, also called an "arrangement number" or "order," is a rearrangement of the elements of an ordered list S into a one-to-one correspondence with S itself. A string of length n has n! permutations

1. **Input Format**
   First line contains the input string

2. **Output Format**
   Output all possible permutations
3. **Constraints**
   Duplicate characters not allowed in the input string

4. **Example**
   ABC
   ACB
   BAC
   BCA
   CAB
   CBA

2. Pair of Socks
There are A red socks, B green socks and C Yellow socks in a dark room. Ashwin wants to find N pairs of matching colored socks from the dark room.

Given all A, B and C are even and N ≤ (A+B+C)/2, write a program that outputs how many socks Ashwin would have to draw from the dark room in the worst case, to have exactly N pairs.

1. **Input Format**
   First line contains three space separated integers: A, B and C.
   Second line contains the number of pairs Ashwin wants: N.
2. **Output Format**
   Single line containing a single integer which is the count of socks needed to draw in the worst case

3. **Constraints**

   $0 \leq A,B,C \leq 10^6$

   $0 \leq N \leq (A + B + C)/2$

4. **Example**

   Input 1:

   2 4 4

   1

   Output 1:

   4

   Input 2:

   2 4 4

   4

Output 2:

9

Input 3:

2 4 4

5

Output 3:

10