Doubt Solving Session

Course on C-Programming & Data Structures: GATE - 2024 & 2025

Vishvadeep Gothi • Lesson 22 • Dec 21, 2022

Data Structure:
Doubts & Array 2

By: Vishvadeep Gothi

Hello!

I am Vishvadeep Gothi

I am here because I love to teach

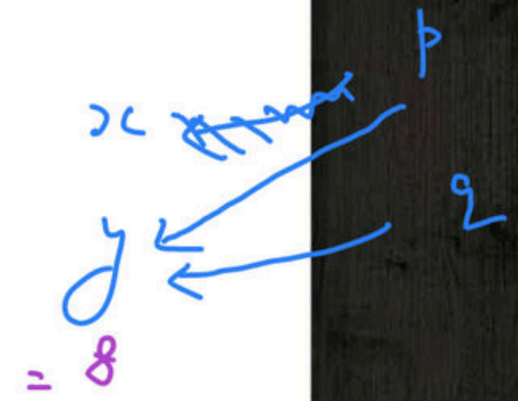
Vishvadeep Gothi: Profile

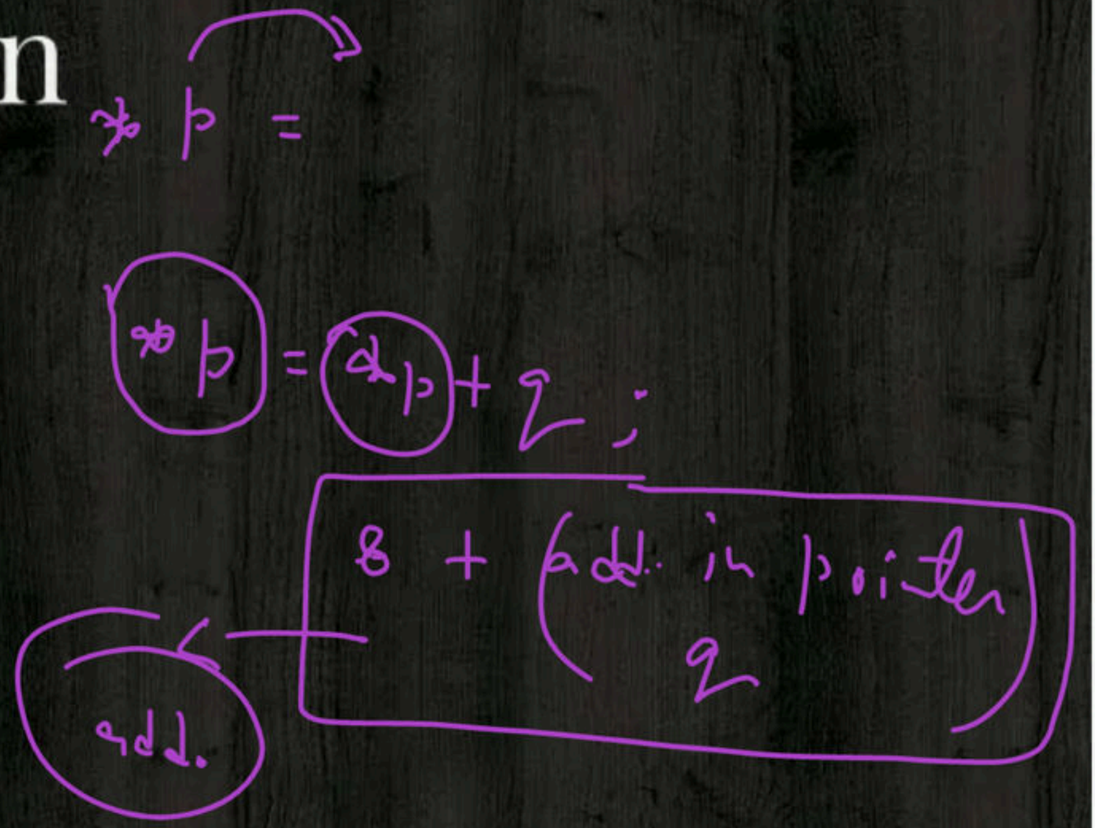
- **GATE Ranks:**
  - 682 (2009) – 3rd year
  - 19 (2010) – 4th year
  - 119, 440 etc.
- **Education:**
  - ME from IISc Bangalore
  - Mtech from BITS-pilani in Data Science
- **Work:**
  - 13 Year Teaching Experience
  - 9+ in GATE/IES (GateForum, Gate Academy, ACE)
  - Worked in Cisco, Audience Communication
- **Professions:**
  - Freelance S/W developer
  - Educator
  - CrossFit Trainer

Question

The value printed by the below program is:

```
#include <stdio.h>
void find (int *p, int *q){
p=q;
*p=*p + q;
}
void main (){
int x=5, y=8;
find (&x, &y);
printf("%d", x+y+1);
}
```

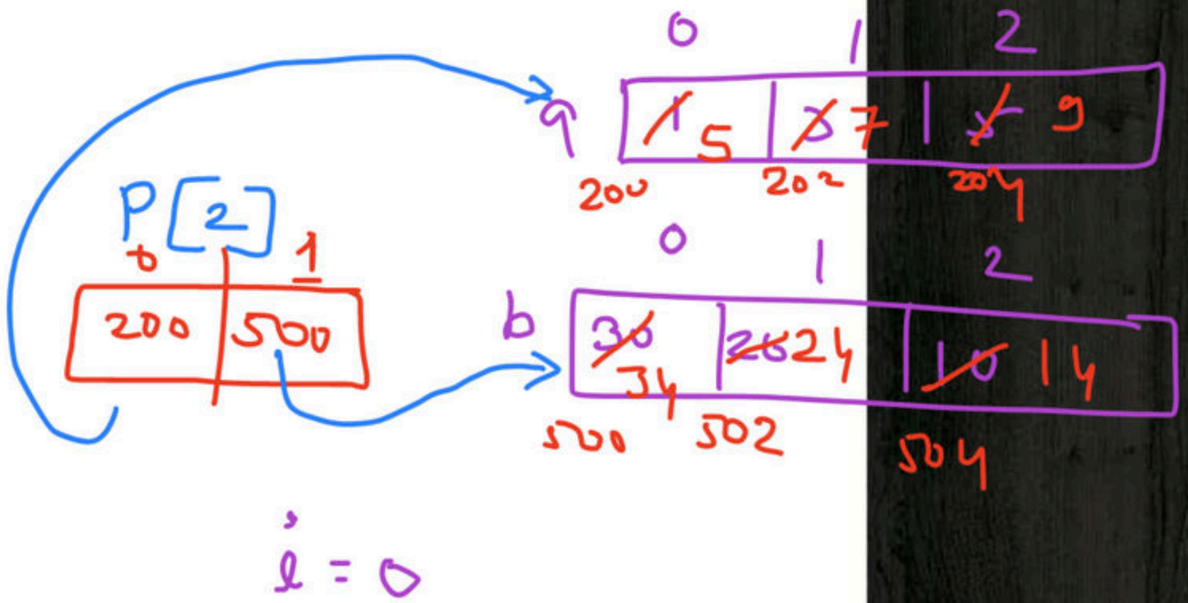




Question

Value returned by below C-language function when called for f(4)?

```
int f(int x){
int a[3]={1,3,5};
int b[3]={30,20,10};
int i=0;
int *P[2];
P[0]=a;
P[1]=b;
for(i=0;i<3;i++){
P[0][i] += x;
P[1][i] += x;
}
return *P[0]+*P[1];
}
```



x = 4

5 + 34 = 39

39

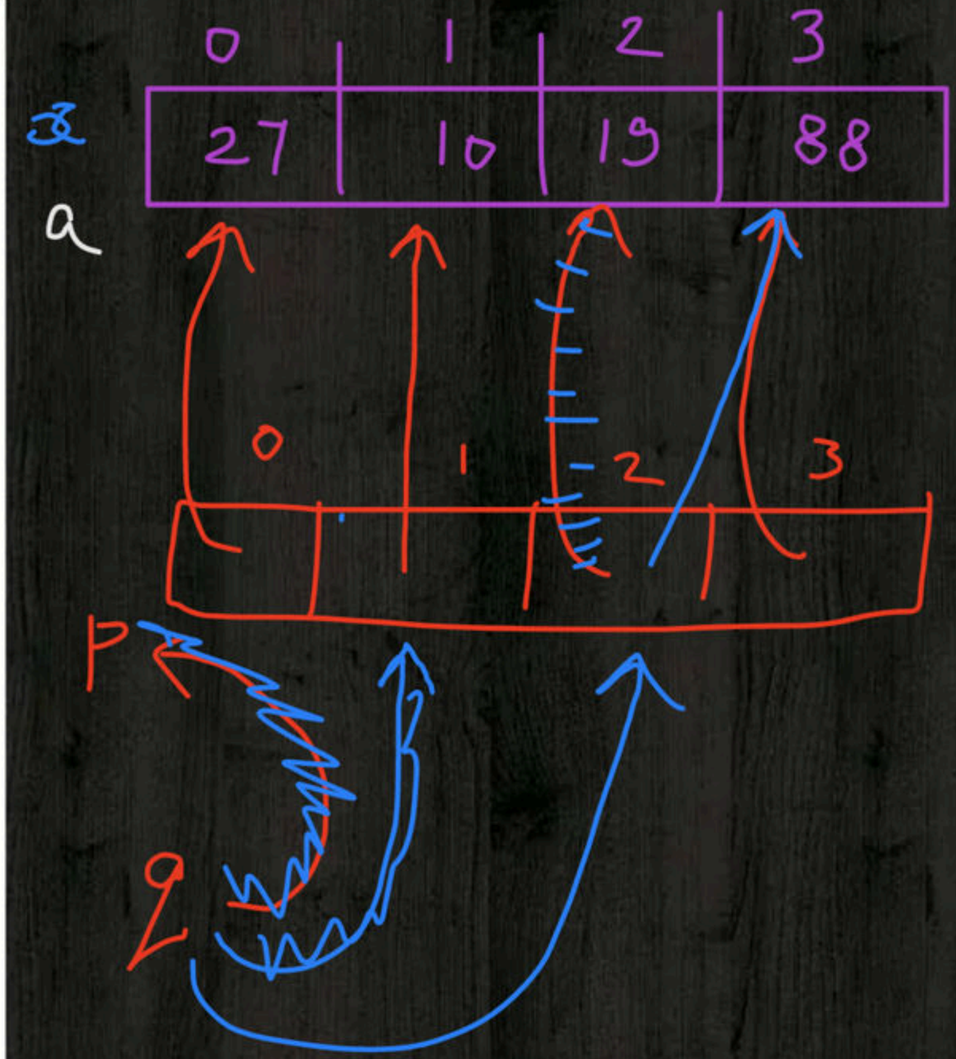
Question

The output of the following C-program is?

```
#include <stdio.h>

void f(int a[]){
int *p[]={a,a+1,a+2,a+3};
int **q;
q=p;
q++;
*(++q);
++(*q);
printf("%d",**q);
}
void main(){
int x[]={27,10,19,88};
f(x);
}
```

88



Question

The output of the following C-language program:

```
#include<stdio.h>
void fun (char *x, char *y) {
char *str;
str=x;
x=y;
y=str;
}
void main(){
char *p="Vishvadeep";
char *q="Gothi";
fun(p,&q);
printf("%s, %s", p, q);
}
```

p → "Vishvadeep"

q → "Gothi"

fun(p, &q);

Gothi, Vishvadeep

Question

```
struct test{
int x;
float y;
};
void main{
struct test *s[10];
}
```

The variable s here is defined as:

- An array, each element of which is a structure of type test
- A structure of 2 fields, each field being a pointer to an array of 10 elements
- An array of size 10, each element of which is a pointer to a structure of type test
- None

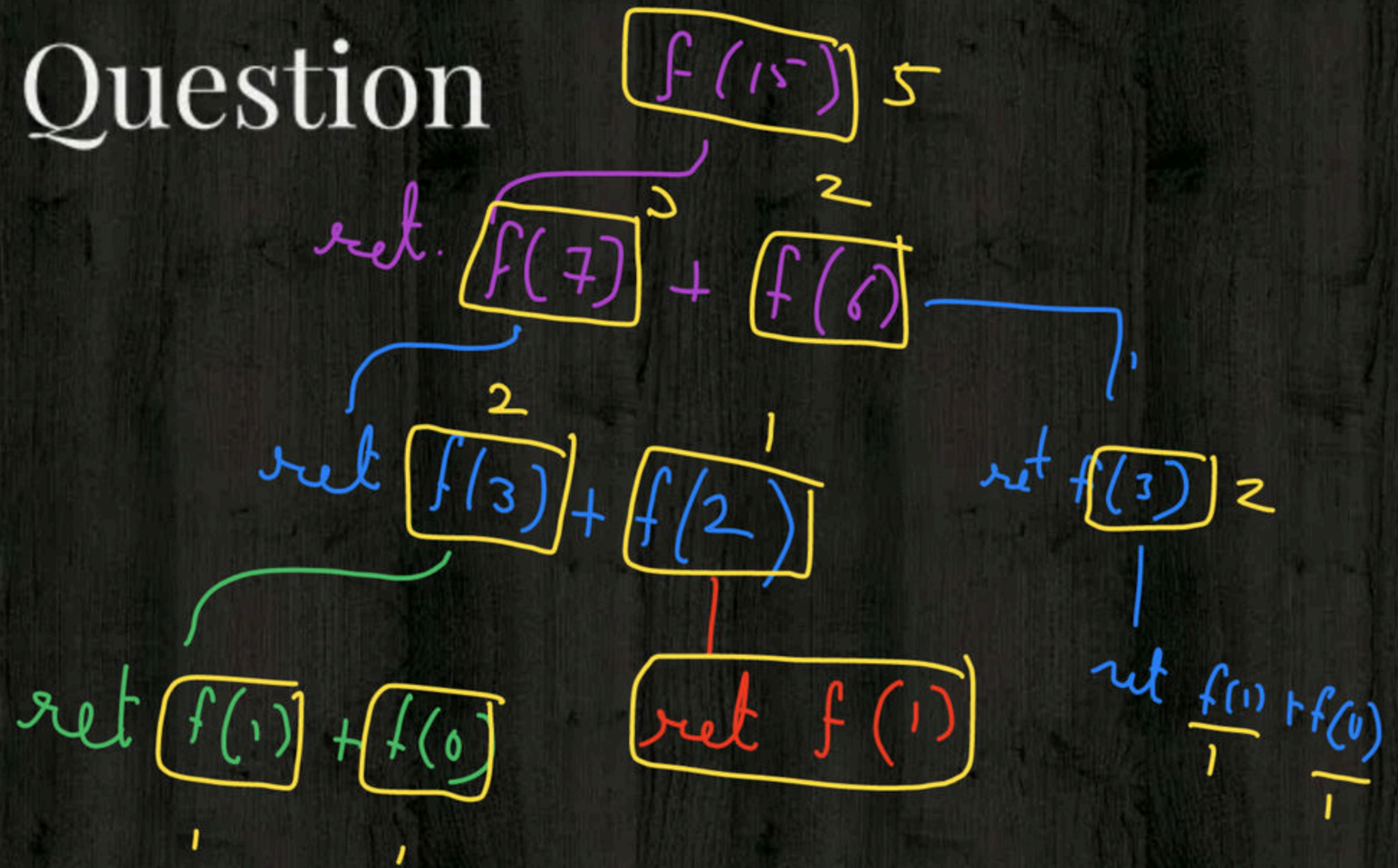
Ans = 5

Question

The output printed by below program is:

```
#include<stdio.h>
int fun(int n){
if(n<=1) return 1;
if(n%2 != 0) return fun(n/2) + fun(n/2-1);
else return fun(n/2);
}

void main()
{
printf("%d", fun(15));
}
```



Array

- Collection of homogeneous elements
- Characteristics:
  1. All elements stored on consecutive memory locations
  2. All elements can be accessed using a set of indexes

Array

A[LB:UB] ⟹ A[LB ..... UB]

A[3:8]

B[-2:15]

Array A[1....5]

B[-2 ..... 12]

Location of an Array Element

Address (A[i]) = Base + w * (i - LB)

relative index

Why Indexing from Zero?

Traversing in Array

for k = LB to UB , step by 1

process A[k]

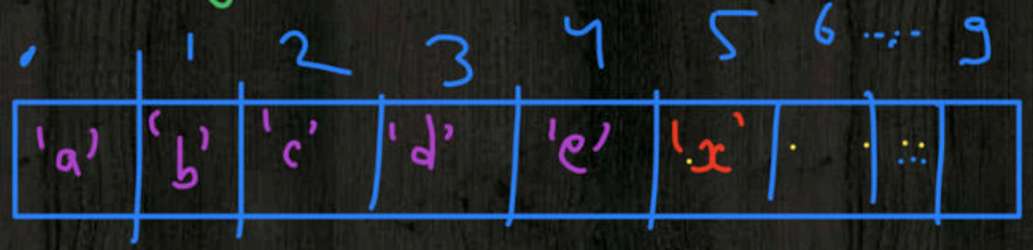
R.T. complexity = $\theta(n)$

space complexity = constant

Insertion in Array

always at the end

based on index



LB = 0

UB = ~~4~~ 5

n = ~~5~~ 6

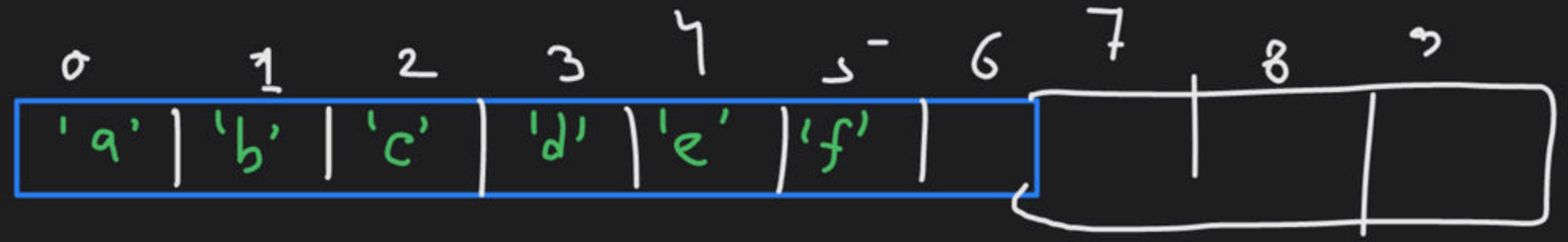
```
if (UB == array_UB)
{ printf ("overflow");
  return;
}
UB++;
A[UB] = item;   n++;
```

R.T. complexity = Constant

Based on index:-

Insertion (A[], LB, UB, n, item, i)

new element to be inserted on index i.



n = 6

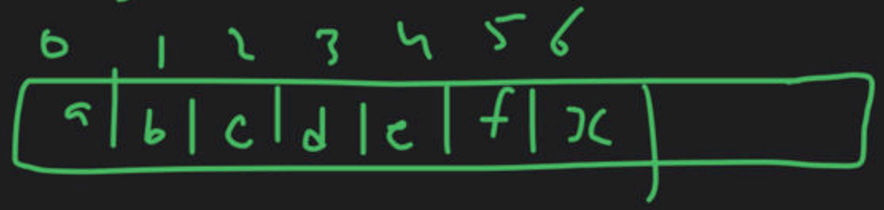
LB = 0

UB = 5

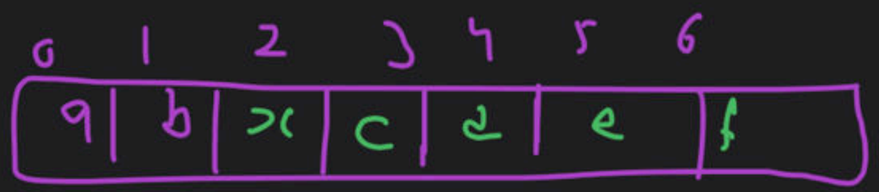
item = 'x'

LB ≤ i ≤ UB + 1

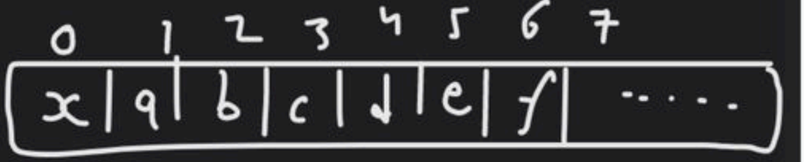
if i = 6



if i = 2



if i = 0



```
if (UB == array_UB)
{
  printf("overflow");
   return ;
}
if ( i < LB  ||   i > (UB+1) )
{
  printf("Invalid index i");
   return ;
}
for(k = UB ; k >= i; k--)
{
   A[k+1] = A[k];
}
```

```
A[i] = item;
UB++;
n++;
```

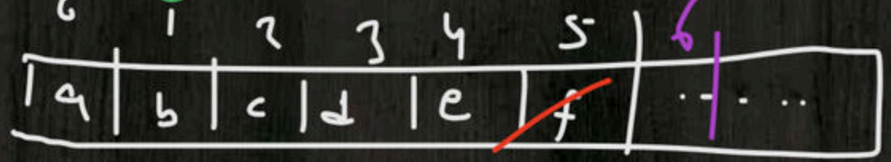
Run time complexity = $O(n)$

space complexity = $\theta(1)$

Deletion in Array

always last element

based on index



LB = 0

UB = ~~4~~ 5

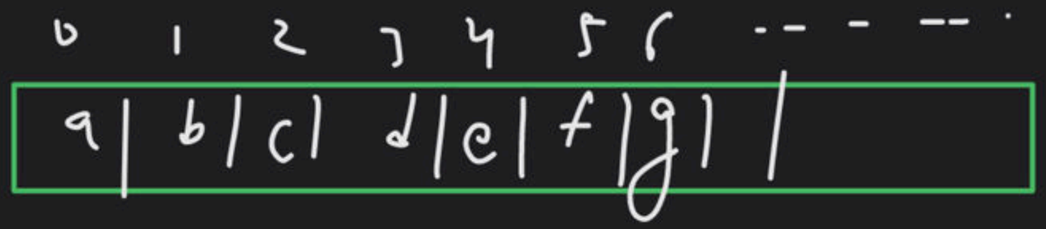
n = ~~6~~ 5

```
if (UB == -1)
{
    printf ("underflow")
    return;
}
UB--;
n--;
```

R.T. Complexity = $\Theta(1)$

Space - " — = $\Theta(1)$

Based on index



index i =>

$LB \leq i \leq UB$

Deletion (A[], LB, UB, n, i)

{

$i = 2$

}

```
if (UB == -1)
{
    printf ("Underflow");
    return ;
}
if ( i < LB || i > UB)
{
    printf (" invalid index");
    return;
}
for( k = i; k < UB; k++)
{
    A[k] = A[k+1];
}
   UB--;
   n--;
```

R.T. Complexity = $O(n)$

space — " — = $\theta(1)$

Finding Minimum Element

Finding Maximum Element

Finding Minimum & Maximum Both

Question GATE-2014

The minimum number of comparisons required to find the minimum and the maximum of 100 numbers is _____?

Finding Second Minimum

Searching in Array

1. Linear Search
2. Binary Search

Linear Search

Binary Search

Question

Consider a sorted array of size n with duplicate elements. You have been given an element k, what is the time complexity to find the frequency of element k in the array?

(A) O (1)

(B) O (log n)

(C) O(n)

(D) None

Question

Consider a sorted array of size n with duplicate elements. You have been given an element k, what is the time complexity to find that the element k is appeared atleast n/3 times or not?

(A) O (1)

(B) O (log n)

(C) O(n)

(D) None

Question

Consider a sorted array of size n with duplicate elements. Find the time complexity to find whether an elements is appeared more than n/2 times or not in the array?

(A) O (1)

(B) O (log n)

(C) O(n)

(D) None

DPP

Question 1

Consider an array of size n-1 elements which contains elements between 1 to n (all unique) but 1 number is missing. Find the missing number?

Question 2

Consider an array A[-6 ..... 15], which is stored in memory starting from location 1000. Assume each element in memory is stored on 4 locations. Then the location of element A[2] is?

Question 3

There are n students in the class and the teacher is going to find the leader of the class. The teacher applies a simple strategy to find the leader as follows:
Teacher asked all students to stand in a single queue then given them numbering from 1 to n, starting from first student to last student. Then teacher has removed all students with odd numbering i.e. 1, 3, 5 ….
For remaining students teacher given numbering once again from 1 without changing their relative order and then removed the odd number students again from the queue. Teacher repeated the same till there is only 1 student remaining in the queue. That one student becomes leader of the class.
Assume you want to be the leader then in the initial queue of n students on which position you will stand so that you can become the leader?

Happy Learning