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Question 1. (10 points) Read the following C program and write the output for the five separate input values.

```
#include<stdio.h>

void permute(int* arr, int n) {
        int i;
        for(i=1;i<n;i++) {
            if(arr[i]>=arr[i-1])
            continue;
        int j;
        for(j=0;j<i;j++) //place arr[i] correctly
                if(arr[j]>arr[i]) {
                        int k=j;
                        int prev = arr[k];
                        arr[k] = arr[i];
                        for(k=j+1;k<=i;k++) {
                                int curr = arr[k];
                                arr[k] = prev;
                                prev = curr;

                        }
                        break;
                }//end if
    }
}

int compute(int *A, int n) {
        int i;
        permute(A,n);
    for(i=n-1; i>=0; i--)
        if(*(A+i) < n-i) break;
    return n-1-i;
}

int main() {
   int n,i,A[5];
   scanf("%d",&n);
   for(i=0;i<n;i++)
        scanf("%d",A+i);
   printf("%d\n", compute(A,n));
   return 0;
}
```

when a[i] < a[i-1] we move

A[i] < n-i

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n the output in the box.

Input	Output
2 -1 -2	1
3 3 0 2	2
4 1 0 0 0	1
4 9 10 8 3	4
4 10 4 6 5	4

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Question 2. (10 points) Complete the following program which does the following. The program takes as input a positive integer n followed by a sequence of n-numbers which form an arithmetic progression with exactly one number *missing* in the arithmetic progression. The program should output the missing number.

For example, if $n = 4$ and the sequence of numbers is 2 5 11 14 then the program should output 8. (Explanation: It is an arithmetic progression with start=2 and difference=3.)

```
1  #include <stdio.h>
2
3  int findAP(int* A, int lo, int hi, int diff) {
4
5    int m;
6    m = lo + hi /2;
7
8    if ((a[m+1]-a[m]) != diff )
9      return (*(A+m) + diff);
10
11   if (m > 0 && (a[m] - a[m-1]) != diff )
12     return (*(A+m-1) + diff);
13
14   if (a[m]-a[0] = m * diff )
15     return findAP(A, m+1, hi, diff);
16
17   return findAP(A, lo , m-1 , diff);
18 }
19
20 int main() {
21   int* a;
22   int n, i, diff;
23   scanf("%d",&n);
24   a = (int*) malloc(n*sizeof(int));
25   for(i=0;i<n;i++)
26         scanf("%d", a+i);
27
28   diff = (a[n-1] - a[0] )/ n ;
29
30   printf("Missing element: %d\n", findAP(a, 0, n-1, diff));
31   return 0;
32 }
```

(9)

(a[m+1]-a[m]) != diff
(a[m]-a[m-1]) != diff

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Question 3. (10 points) Read the following C program and figure out the output for the five separate input values.

```
#include<stdio.h>
#include<stdlib.h>

int func(int a, int inc, int b) {
  int p, n, r;

  if (abs(a) > b)  return 1000;
  if (a == b)      return inc;

  p = func(a+inc+1, inc+1, b);
  n = func(a-inc-1, inc+1, b);

  if (p < n) r=p;
  else r=n;

  return r;
}

int main() {
  int n;
  scanf("%d",&n);
  printf("%d\n", func(0, 0, n));
  return 0;
}
```

Neatly fill in the output in the box.

Input	Output
1	1 ✓
4	3 ✓
5	5 ✓
6	3 ✓
9	5 ✓

10

0, 0, 1
p = f(1, 1, 1) = 1
n = f(-1, 1, 1) = 2
p = f(1, 2, 1) → 2
n = f(-3, 2, 1) → 1000
f(0, 0, 4) → f(1, 1, 4)
(0, 0, 4) → (1, 1, 4)
(3, 2, 4)
(-1, 2, 4)
(2, 3, 4) (-4, 3, 4)
1000
(-2, 4
(1, 5
1000 100

1, 1 → 3, 2 → 6 3 → 1000 → 7, 5
→ 2, 4
(2, 2) → (6, 3) → (10, 4)
→ (5, 4) → (10,