Prove using **mathematical induction** or **disapprove** by **counterexample,** that the following two code segments will produce and print the same output for any integer value n>=1.

If you use mathematical induction, then *you should* ***explain*** *each step* and *you should* ***highlight*** P(n), P(k), P(k+1), the inductive hypothesis, etc. Explaining each step is very important.

=============== segment 1 ========================

```
int i,n,s=0;
printf("enter any positive integer value\n");
scanf("%d", &n);
if(n >= 1){
    for(i=1; i <= n; ++i){
        s+=  (i*(i+1)) / 2 ;
    }
    printf("The summation = %d \n", s);
}
```

=============== segment 2 ========================

```
int i,n,s=0;
printf("enter any positive integer value\n");
scanf("%d", &n);
if(n >= 1 ){
    s = ( n * (n+1) * (n+2)) / 6 ;
    printf("The summation = %d \n", s);
}
```

[redacted]

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Discrete Mathematics

Quiz #3

Q.1 Segment 1 will print $\sum_{i=1}^{n} \frac{i(i+1)}{2}$, $n \geq 1$

segment 2 will print $\frac{n(n+1)(n+2)}{6}$, $n \geq 1$

Show that

then : $\sum_{i=1}^{n} \frac{i(i+1)}{2} = \frac{n(n+1)(n+2)}{6}$ ← $P(n)$ $n \geq 1$

① Basis Step : Show that $P(1)$ is true .

$P(1)$ L.H.S $\sum_{i=1}^{1} \frac{1(1+1)}{2} = 1$, R.H.S $\frac{1(1+1)(1+2)}{6} = 1$

so, L.H.S. = R.H.S = 1 , thus $P(1)$ is true

② Inductive Step : show that for all integers $K \geq 1$ (Particular but arbitrarily chosen) if $P(K)$ is true, then $P(K+1)$ is also true.

Suppose $\sum_{i=1}^{K} \frac{i(i+1)}{2} = \frac{K(K+1)(K+2)}{6}$ is true ← $P(K)$ inductive hypothesis

$\sum_{i=1}^{K+1} \frac{i(i+1)}{2} = \frac{(K+1)(K+2)(K+3)}{6}$ ← $P(K+1)$

L.H.S → $\sum_{i=1}^{K+1} \frac{i(i+1)}{2} = \underbrace{\sum_{i=1}^{K} \frac{i(i+1)}{2}}_{P(K)} + \frac{(K+1)(K+2)}{2}$ by inductive hypothesis

$= \frac{K(K+1)(K+2)}{6} + \frac{3(K+1)(K+2)}{2_{(3)}} = \frac{K(K+1)(K+2) + 3(K+1)(K+2)}{6}$

$= \frac{(K+1)(K+2)[K+3]}{6} = \frac{(K+1)(K+2)(K+3)}{6}$ = R.H.S.

so, L.H.S = R.H.S , then $P(K+1)$ is true when $P(K)$ is true

Thus $P(n)$ is true for all integers $n \geq 1$