Hands-On (3)

1. function $x = f(n)$

```
x = 1;
for i=1:n
  for j=1:n
    x=x+1;
```

$$T(n) = \sum_{i=1}^{n} \sum_{j=1}^{n} (1)$$

$$= \sum_{i=1}^{n} n$$

$$= 1+2+3+\dots n$$

$$= \frac{n(n+1)}{2}$$

$$\therefore T(n) = \frac{n(n+1)}{2}$$

3. Using limit function

$\frac{n(n+1)}{2}$ (Upper Bound Function)

$0 \le f(n) \le c\,g(n) \quad n \ge n_0$

$0 \le \frac{n(n+1)}{2} \le c\,g(n) \quad g(n) = n^2$

$0 \le \frac{n^2+n}{2} \le cn^2 \quad$ if $c = 1$

$0 \le \frac{n^2+n}{2} \le n^2 \quad n_0 = 0$

$\therefore$ Upper Bound Function is n^2 $O(n^2)$

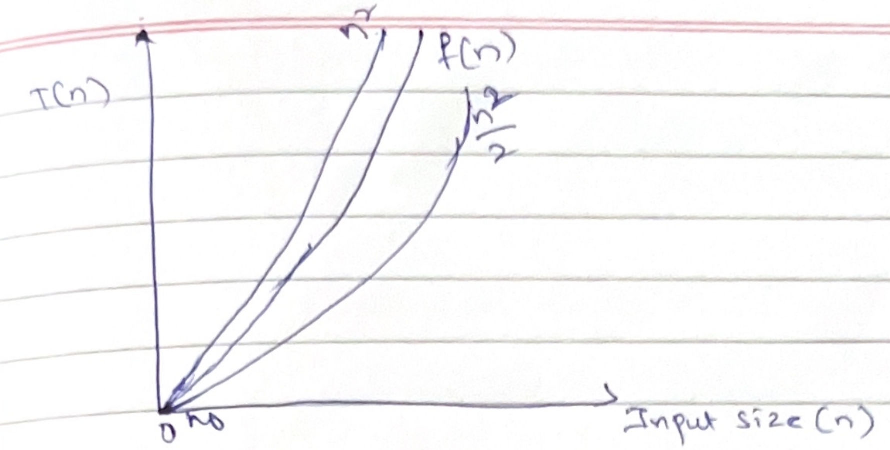
Lower Bound $f(n) \ge c\,g(n)$

$g(n) = n^2 \quad c = \frac{1}{2}$

$\frac{n^2+n}{2} \ge \frac{n^2}{2} \quad n_0 = 0$

$\therefore$ Lower Bound Function is $\frac{n^2}{2}$ $\Omega(n^2)$

④



$n_0 = 0$, The value n_0 satisfies both the conditions i.e., at 0 the values are equal and as n grows f(n) grows with n^2 but less than it & greater than $\frac{n^2}{2}$.

⑤ It doesn't affect the asymptotic results from 1.
i it; is a constant factor, it slightly increase the curve compared to the first, but it too follows the quadratic shape. The overall growth rate is still quadratic.