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# CSCI 104 HW1

a.) 
```
void f1(int n)
{
    int i=2;
    while(i < n){
        /* O(1) time */
        i = i*i
    }
}
```

| n | i | iterations |
|---|---|---|
| 0 | 2 | 0 |
| 1 | 2 | 0 |
| 2 | 2 | 0 |
| 3 | 4 | 1 |
| 4 | 4 | 1 |
| 5 | 16 | 2 |
| 6 | 16 | 2 |
| 7 | 16 | 2 |
| ⋮ | ⋮ | ⋮ |
| n | $2^{\frac{n}{2}}$ | $\log_2 n - 1$ |

$f(n) = \log_2 n - 1$

$\boxed{O(n) = \log_2 n}$

b.)
```
void f2(int n)
{
    for(int i=1; i <= n; i++){          O(n)
        if((i % (int)sqrt(n)) == 0){    O(n-√n)
            for(int j=0; j < pow(i,3); j++){   O(n^3)
                */ O(1) tim */
            }
        }
    }
}
```

| n | i | j | iterations O(n) |
|---|---|---|---|
| 0 | 1 | 1 | 0 |
| 1 | 1 | 0 | 1 |
| 2 | 2 | 0 | 1 |
| 3 | 2 | 0 | 1 |
| 4 | 3 | | |

$O(n) = O(1) \times O(n) \times O(n-\sqrt{n}) \times O(n^3) \Rightarrow n^5 - n^5\sqrt{n}$

$\boxed{O(n) = n^5}$

c) O(n)

```
for(int i=1; i<=n; i++){
    for(int j=1; j<=n; j++) {                O(n)
        if( A[j] == i) {                     O(n)
            for(int k=1; k<=n; k=k+k) {      O(log_2 n)
                */ O(1) tim */
            }
        }
    }
}
```

$O(n) = O(1) * O(n) * O(n) * O(n) * O(\log_2 n) = \boxed{O(n^3 \log_2 n)}$

d)

```
int f (int n)
{
    int *a = new int[10]
    int size = 10;
    for(int i=0; ; i<n; i++) {                O(n)
        if(size == i) {                       O(1)
            int newsize = 3 * size/2;
            int *b = new int[newsize];
            for(int j=0; j<size; j++)  b[j] = a[j];   O(10)
            delete [] a;
            a=b;                              O(1)
            size = newsize;
        }
        a[i] = i*i;
    }
}
```

$O(n) = O(1) * O(10) * O(1) * O(n) = O(10n) \Rightarrow \boxed{O(n)}$