Mitali Juneja (mj2944)

1 2.1 ~~N~~, ~~$\sqrt{N}$~~, ~~$N^{1.5}$~~, ~~N^2~~, ~~$N \log N$~~, ~~$N \log \log N$~~, ~~$N \log^2 N$~~, ~~$N \log(N^2)$~~, ~~$\frac{2}{N}$~~, ~~2^N~~, ~~$2^{\frac{N}{2}}$~~, ~~37~~, ~~$N^2 \log N$~~, ~~N^3~~

$\frac{2}{N}$, 37, $\sqrt{N}$, N, $N \log \log N$, $N \log N = N \log(N^2)$, $N \log^2 N$, $N^{1.5}$, N^2, $N^2 \log N$, N^3, $2^{\frac{N}{2}} = 2^N$

2 2.6 day 1 = 2, day 2 = 4, day 3 = 16, day 4 = 256, day 5 = 65536

a start at day N=1 with a fine of $2, then the fine on day $\boxed{N = 4^{2^{(N-2)}}}$

b $D = 4^{2^{(N-2)}}$

$D = 4^{\frac{2^N}{2^2}} \rightarrow D = 4^{2^N}$ $\quad 2^N = 4^{\frac{1}{2}N}$

$\log_4 D = \log_4 2^N = \log_4 4^{\frac{N}{2}}$

$\log_4 D = \frac{N}{2}$

$N = 2 \log_4 D$

$\boxed{N = \log D}$

3 2.7a 1.
```
sum = 0;
for (i=0; i<n; i++) =n → O(n)
    sum++;
```

2.
```
sum = 0;
for (i=0; i<n; i++) =n
    for (j=0; j<n; j++) =n → O(n^2)
        sum++;
```

3.
```
sum = 0;
for (i=0; i<n; (i++)  =n → O(n^3)
    for (j=0; j< n*n ; j++) =n^2
        sum++;
```

4.
```
sum = 0;
for (i=0; i<n; i++)  =n → O(n^2)
    for (j=0; j<i; j++)  0, 1, 2, ..., n-1 →
        sum++;           (n-1)n / 2 → n^2
```

Mitali Juneja (mj2944)

5. sum = 0;
for (i = 0; i < n; i++) = n → $O(n^5)$
for (j = 0; j < i * i; j++)
for (k = 0; k < j; k++)) → $\frac{(n^2-1)(n^2)}{2} = n^4$

i = 0 i = 1 i = 2 i = 3 ... i = n-1
0+1+2+3 = 6 0+1+2+3+4+...8 = 36 0 to n^2-1

6 sum = 0;
for (i = 1; i < n; i++) = n
for (j = 1; j < i * i; j++) n^2 → $O(n^5)$
if (j % i == 0)
for (k = 0; k < j; k++) n^2 → assume this case always runs for 0
sum++;

4 2.10a add 2 N digit numbers
sum = 0, carry = 0
for (i = n-1 to 1 = 0) = n → $O(N)$
sum += ((n1i + n2i + carry) % 10) * 10^{power}
if (n1i + n2i + carry > 9)
carry = 1

5 2.11 0.5 ms for N = 100, time for N = 500
a 0.5(5) = 2.5 ms for linear
b 0.5(5)($\frac{\log 500}{\log 100}$) = 3.37 ms for O(N log N)
c 0.5(5^2) = 12.5 ms for quadratic
d 0.5(5^3) = 62.5 ms for cubic

6 2.15 Ai = i for an array $A_1 < A_2 < A_3 < \ldots < A_N$

1	2	5	7	8
0	1	2	3	4
1	2	3	4	5

$\frac{4+0}{2} = 2$ ← Ai > i, Ai < i

0	1	2	3	5
1	2	3	4	5

```
boolean hasMatchingIndexEl(int[] arr){
    int beg = 1; int end = arr.length;
    int mid;
    while (beg <= end){
        mid = beg + (end - beg)/2;
```

Mitali Juneja (mj2944)

```
    if(arr[mid-1] > mid)
        end = mid-1;
    else if (arr[mid-1] < mid)
        beg = mid+1;
    else if(arr[mid-1] == mid)
        return true;
  }
  return false;
}
```

→ each time, splits the portion of the array to consider in half (like binary search)

O(log N)

3.1

```
void printLots(L, P){
  int lIdx=0;
  Iterator<T> lIter = L.iterator();
  Iterator<Integer> pIter = P.iterator();
  int toPrint;
  while (p.Iter.hasNext() ){
      toPrint = pIter.next();
      while (lIter.hasNext()) {
          if(lIdx == toPrint){
              System.out.println(lIter.next());
              lIdx++;
              break;
          }
          lIdx++;
      }
  }
```

if N=L.size(), O(N)