

CS 113

1) a.

```

1 for(int i=0; i<n; i++)
2   for(int j=0; j<n; j++)
3     System.out.println(i + " " + j);

```

| line | Occ | | |
|------|----------------|---------|---------------------|
| 1 | 1 | 1, n, n | 1 + 2n |
| 2 | n | 1, 1, n | n + 2n ² |
| 3 | n ² | 5 | 5n ² |

$$T(n) = 7n^2 + 3n + 1$$

$$A_0 = 1$$

$$O(n) = O(n^2)$$

$$C = 7 + \frac{3}{n} + \frac{1}{n^2}$$

$$C = 7 + 3 + 1$$

$$C = 11$$

$$11n^2 > 7n^2 + 3n + 1, \text{ when } n > 11$$

```

1 b. for(int i=0; i<n; i++)
2   for(int j=0; j<2; j++)
3     System.out.println(i + " " + j);

```

| line | occ | | |
|------|-----|---------|--------|
| 1 | 1 | 1, n, n | 1 + 2n |
| 2 | n | 1, 3, 2 | 6n |
| 3 | 2n | 5 | 10n |

$$T(n) = 18n + 1$$

$$O(n) = O(n)$$

$$C(n) = 18n + 1$$

$$C = 18 + \frac{1}{n}$$

$$A_0 = 1$$

$$19 = C$$

$$19n > 18n + 1, \text{ when } n > 1$$

C.

```

1 for (int i = 0; i < n; i++)
2     for (int j = n-1; j >= i; j--)
3         System.out.println(i + " " + j);

```

| line | Occ | | |
|------|-----|-------------|-----------------|
| 1 | 1 | 1, n, n | (2n+1) |
| 2 | n | 1, n/2, n/2 | (n + n/2 + n/2) |
| 3 | n/2 | 5 | (5n/2) |

$$(2n+1) + (n + n^2) + (5n^2/2)$$

$$3n + 1 + n^2 + 5n^2/2$$

$$t(n) = \frac{1}{2}n^2 + 3n + 1$$

$$O(n^2) = O(n^2)$$

$$C_i = 7/2 + 3/n + 1/n^2$$

$$n_0 = 1$$

$$C = 7/2 + 3 + 1$$

$$C = 7/2 + 6/2 + 2/2$$

$$C = 15/2$$

$$\boxed{15/2 n^2 > 7/2 n^2 + 3n + 1, \text{ when } n > 1}$$

```
do: for int i=1; i<n; i++)
```

3 1/2 10% (20)

2

2.

3

4

$$1 + 3n + \frac{1}{5}n^2 + 5 \log(n)$$
$$T(n) = 7/2 n^2 + 3n \log(n) + 1$$
$$O(n^2)$$
$$e^2 = 7/2 + 3/n + 5/(\log n)/n^2 + \dots$$
$$C = 7/2 + 3 + 5 \log(n) + 1$$
$$= 7/2 + 6/2 + 3/2$$
$$C = 15/2$$
$$\sqrt{15/n^2} > 7/2n^2 + 3n + 5 \log(n) + 1, \text{ wenn } n \geq 1$$