

# CS 330 Intro to the Design and Analysis of Algorithms

## Homework 2

(20 pts)

1. Rank the following functions by order of growth from the slowest to the fastest:

$5n^{100} + n! - 2$ ,  $1000000$ ,  $5000n^2 + n^3$ ,  $2n + 156788 \log n$ ,  $2^n$

2. Determine the time complexity of the following code segments. In each case, justify your answer.

(a) `void printUnorderedPairs(int[] arrayA, int[] arrayB)`

```
{
    for (int i = 0; i < arrayA.length; i++) {
        for (int j = 0; j < arrayB.length; j++) {
            for (int k = 0; k < 100000; k++) {
                System.out.println(arrayA[i] + "," + arrayB[j]);
            }
        }
    }
}
```

(b) `void printUnorderedPairs(int[] arrayA, int[] arrayB)`

```
{
    for (int i = 0; i < 100000; i++) {
        for (int j = 0; j < 100000; j++) {
            for (int k = 0; k < 100000; k++) {
                System.out.println(arrayA[i] + "," + arrayB[j]);
            }
        }
    }
}
```

(c) `int product(int a, int b) {`

```
    int sum = 0;
    for (int i = 0; i < b; i++) {
        sum += a;
    }
    return sum;
}
```

(d) `int sqSum(int n) {`

```
    for (int i = 1; i < n*n; i++) {
        sum += 1;
    }
    return sum;
}
```

3. Use the Gale-Shapley algorithm in the text to find a stable matching for the following men and women, given the preference lists shown for each. Do it 2 times. The first time have the men do the choosing. The second time have the women do the choosing.

Man	Preference list	Woman	Preference list
Adam	Eve, Greta, Hannah, Faith	Eve	Ben, Caleb, Dan, Adam
Ben	Eve, Faith, Greta, Hannah	Faith	Adam, Ben, Caleb, Dan
Caleb	Greta, Eve, Faith, Hannah	Greta	Caleb, Dan, Adam, Ben
Dan	Faith, Eve, Hannah, Greta	Hannah	Ben, Dan, Adam, Caleb

4. Decide whether you think the following statement is true or false. If it is true, give a short explanation. If it is false, give a counterexample.

Consider an instance of the Stable Matching Problem in which there exists a man  $m$  and a woman  $w$  such that  $m$  is ranked first on the preference list of  $w$  and  $w$  is ranked first on the preference list of  $m$ . Then, in every stable matching  $S$  for this instance, the pair  $(m, w)$  belongs to  $S$ .