

Answer all questions. No question should take more than one page.

1. Give formal definitions for O, Omega, Theta, P, and NP.

2. What is the Big-O complexity for the following function?

```
int loopy(int n)
{
    int i, j, k, x;

    x = 0;
    for (i = 0 to n)
        for (j = 0 to n)
            for (k = 0 to n)
                x = x + i * j * k;
    return x;
}
```

3. What is the Big-O complexity for the following function?

```
int f2(int n)
{
    int i, x;

    if (n <= 1) return 1;

    x = n;
    for (i = 0 to n)
        x = x + i;
    return x + f2(n/2) + f2(n/2);
}
```

4. Sketch pseudocode for breadth-first search, and then describe how it is similar to depth-first (your description should mention something about data structures).
5. Describe an algorithm that uses dynamic programming. Choose any algorithm you like (mention what it is, and how dynamic programming is being used).
6. Give an example of an NP-Complete problem, and explain what a “certificate” would mean with respect to this problem.