EECS 3101M: Design and Analysis of Algorithms
Winter 2019
Tutorial 2 (January 18, 2019) - Problems

1. Analyze the running time of the following program for matrix multiplication.

```
MatMult(Y, Z, n)
1  // multiply n x n matrices Y, Z
2  for i ← 1 to n
3  do for j ← 1 to n
4      do X[i, j] ← 0
5          for k ← 1 to n
6          do X[i, j] ← X[i, j] + Y[i, k] * Z[k, j]
7  return x
```

2. Analyze the running time of the following algorithm.

```
power(y, z)
1  // return y^z where y ∈ R, z ∈ N
2  x ← 1
3  while z > 0
4  do if odd(z)
5        then x ← x * y
6      z ← ⌊z/2⌋
7      y ← y^2
8  return x
```

3. Prove that the following algorithm for evaluating the polynomial $a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x + a_0$ is correct. Assume that the coefficient a_i is stored in the array element $A[i]$ for $0 \leq i \leq n$.

```
poly(A, n)
1  v ← 0
2  for i ← n to 0
3  do v ← A[i] + v * x
4  return v
```

4. Prove that the following algorithm that computes the product the values in an array of integers $A[1 \ldots n]$ is correct. Assume that the numbers are small enough to not cause overflow issues.

```
prod(A)
1  prod ← 1
2  for k ← 1 to n
3  do prod ← A[k] * prod
4  return prod
```