

COSC 320 - Advanced Data Structures and Algorithm Analysis  
Spring 2019  
Homework 1

Dr. Joe Anderson

Due: 20 September

1. Answer each as True or False, and provide some justification:

- (a)  $x^2 = o(x^2)$
- (b)  $\log x = \omega(x)$
- (c)  $x \log x = O(x^2)$
- (d)  $x \log x = o(x^2)$
- (e)  $n! = o(n^n)$
- (f)  $n! = \omega(n^n)$
- (g)  $x^5 + 10x + 50 = \Theta(x^5)$
- (h)  $x2^x = O(2^x)$
- (i)  $x2^x = \Theta(2^x)$
- (j)  $1/x = O(1)$
- (k)  $1/x = o(1)$
- (l)  $1/x^2 = o(1/x)$

2. Write the running time of the following algorithm as a precise function  $T(n)$  and give the tightest asymptotic estimate you can:

```
1: function A(n)
2:    $s := 0$ 
3:    $i := 0$ 
4:   while  $i < n^2$  do
5:      $s := s + i$ 
6:      $i := i + 2$ 
7:   end while
8: end function
```

3. Write the running time of the following algorithm as a precise function  $T(n)$  and give the tightest asymptotic estimate you can:

```
1: function B(n)
2:    $s := 0$ 
3:    $i := 0$ 
4:   while  $i < n$  do
5:      $s := s + i$ 
6:      $i := i + 2$ 
```

```

7:   end while
8: end function

```

4. Write the running time of the following algorithm as a precise function  $T(n)$  and give the tightest asymptotic estimate you can:

```

1: function C(n)
2:   s := 0
3:   i := 0
4:   while i < n do
5:     s := s + i
6:     i := i + 4
7:   end while
8: end function

```

5. Write the running time of the following algorithm as a precise function  $T(n)$  and give the tightest asymptotic estimate you can:

```

1: function D(n)
2:   s := 0
3:   i := 0
4:   while i < n2 do
5:     s := s + i
6:     j := i
7:     while j > 0 do
8:       s := s/2
9:       j := j - 5
10:    end while
11:    i := i + 2
12:  end while
13: end function

```

6. Write the running time of the following algorithm as a precise function  $T(n)$  and give the tightest asymptotic estimate you can:

```

1: function D(n)
2:   s := 0
3:   i := 0
4:   while i < n3 do
5:     s := s + i
6:     j := i
7:     while j > 0 do
8:       s := s/2
9:       j := j - 5
10:    end while
11:    i := i + 2
12:  end while
13: end function

```