

COSC 320 - Advanced Data Structures and Algorithm Analysis

Homework 2

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Due: 22 February

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

(a) $x^5 + 10x + 50 = x^5$ **false?**

(b) $x^2 = o(x^2)$

(c) $\log x = \omega(x)$

(d) $x \log x = O(x^2)$

(e) $x \log x = o(x^2)$

(f) $n! = o(n^n)$

(g) $n! = \omega(n^2)$

(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 runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that 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 runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that you can:

```
1: function B(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
```

4. Write the runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that 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 runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that you can:

```

1: function D(n)
2:    $S := 0$ 
3:    $i := 0$ 
4:   while  $i < n^2$  do
5:      $s := s + i$ 
6:      $j := i$ 
7:     while  $j \geq 0$  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 runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that you can:

```

1: function E(n)
2:    $S := 0$ 
3:    $i := 0$ 
4:   while  $i < n^3$  do
5:      $s := s + i$ 
6:      $j := i$ 
7:     while  $j \geq 0$  do
8:        $s := s/2$ 
9:        $j := j - 5$ 
10:    end while
11:     $i := i + 2$ 
12:  end while
13: end function

```