

MIDTERM 1
Introduction to Computer Science COMP 250
Wed. Oct. 5, 2016
Professor Michael Langer

Use the name that corresponds to your McGill email: FIRSTNAME.LASTNAME@mail.mcgill.ca

LAST NAME: _____

FIRST NAME : _____

McGILL ID: _____

GRADE: _____ /10

Instructions:

- This is a closed book exam. You are *not* allowed a crib sheet.
- No electronic devices. You may use your cell phone as a clock only.
- Turn over the exam when you are done (or leave, if you are close to a row exit.)
- Do not talk until *all* the exams are collected.

1. **(1 point)**

What is the following sum ? The numbers are in base 8 and your answer should be in base 8.

$$\begin{array}{r} (143)_8 \\ + \quad (436)_8 \\ \hline \end{array}$$

2. **(1 point)**

Convert the decimal number 85 to binary.

3. (2 points)

Add *two* missing instructions into the pseudocode below.

The method should insert an element *e* into position *i* in an array list *a*[].

You may assume that the index *i* is valid and that the array is not yet full.

Use arrows to indicate where your instructions go.

```
insert(i,e){  
  
    for (j = size; j > i; j--){  
  
    }  
  
    size = size + 1  
}
```

4. (2 points)

Add *two* missing pseudocode instructions below. The method should remove the last element of a *doubly* linked list. Unlike the doubly linked list in the lectures, here you should assume there are *no* dummy nodes.

Use arrows to indicate where your instructions go.

```
removeLast(){  
  
    tmp = tail  
  
    return tmp.element  
}
```

5. (1 point)

Consider a stack. Give a sequence of exactly five **push** and **pop** operations such that:

- the elements are *pushed* onto the stack in the following order: A, B, C, D, E.
- elements are *popped* from the stack in the following order: B, D, E, C, A.

Note that your answer should have five pushes and five pops. You just need to determine the order.

6. (1 point)

Suppose a circular array of size 4 is used to implement a queue. Show the contents of the array after the following sequence of operations: `enqueue(D)`, `dequeue()`, `enqueue(E)`.

Assume the array state *before* these operations is `[- , B, C, -]` where B is the head. Note the array indices are `[0, 1, 2, 3]` .

7. (2 points)

Use mathematical induction to prove that, for all $n \geq 4$, $2^n \leq n!$.