

CPSC 131 Homework 4

Deadline: Monday, October 15 (Mon, Wed sections)
Tuesday, October 16 (Tue, Thu sections)

Turn in your submission as a hard copy in class. Complete all homework problems. However, only some questions may be graded for credit.

Refer to your instructor's syllabus addendum to see their policy on group work. Some instructors allow homework to be completed in groups.

#1

Consider the following sequence of operations:

```
stack<string> ds;  
ds.push("MATH 270A.03");  
ds.push("CPSC 131.01");  
ds.pop();  
ds.push("HIST 101.01");
```

- a) Assume that you are using a **singly-linked list-based stack**. Draw a sketch of the contents of this data structure *after the last operation* (you may however find it easier to draw after each step). Make sure to show both the nodes and the head and tail pointers. [Hint: your sketch will look like the animations in textbook chapter 5.12]
- b) Assume that you are using an **array-based stack of capacity 5**. Draw a sketch of the contents of this data structure *after the last operation* (you may however find it easier to draw after each step). Make sure to show both the array and the top index variable.

#2

Consider the following sequence of operations:

```
queue<string> ds;  
ds.push("MATH 270A.03");  
ds.push("CPSC 131.01");  
ds.pop();  
ds.push("HIST 101.01");
```

- a) Assume that you are using a **singly-linked list-based queue**. Draw a sketch of the contents of this data structure *after the last operation* (you may however find it easier to draw after each step). Make sure to show both the nodes and the head and tail pointers. [Hint: your sketch will look like the animations in textbook chapter 5.14]

b) Assume that you are using an **array-based queue of capacity 5**. Draw a sketch of the contents of this data structure *after the last operation* (you may however find it easier to draw after each step). Make sure to show both the array and the front, rear, and size index variables.

#3

Consider creating an application where you have to repeatedly print out the weekly schedule of classes for every week - the output would be something like:

```
Week 1: CPSC 131.01
Week 1: MATH 270A.03
Week 1: HIST 101.01
Week 2: CPSC 131.01
Week 2: MATH 270A.03
Week 2: HIST 101.01
Week 3: CPSC 131.01
Week 3: MATH 270A.03
Week 3: HIST 101.01
...
```

What data structure would be most appropriate to store the list of courses, *a stack* or *a queue*? Do *not* write code, instead describe the reasoning for your choice in 3-4 sentences.

#4

Complete the following table with the Big-O time complexity of the following operations for different implementations. n is the number of elements in the data structure. The first box has already been filled in for you.

	Linked-list based stack	Array-based stack	Linked-list based queue	Array-based queue
Push	$O(1)$			
Pop				
Peek (Top or Front)				

Optional: what would be the Big-O complexity of the constructor and destructor (which has to delete all the memory) for the data structure.