Assignment 4

COMP 206 (T4 - 2020)

Submit a single pdf file containing all your solutions. The programming language for answers is C_0 or C_1. All the questions carry 10 marks.

1. Answer the following:
   - (a) What is the name of the type defined by `typedef int myfunc(int a);`.
   - (b) Suppose `int abc(int a);` is the header of some function, what does `&abc` refer to?
   - (c) Define a function-type which takes two strings and returns an int.
   - (d) Write a command for allocating an array of function pointers of the type defined in (c) above which can store 10 elements.

2. You are given a library implementing integer min-heap using interface given below. Use it to write a function with the header `void sort(int* A, int n)`, where `A` is an array with length `n`. The function should sort the array in ascending order.

```
// typedef ______* pq_t;

bool pq_empty(pq_t Q)           //O(1)
/*@requires Q != NULL; @*/ ;

pq_t pq_new()                   //O(1)
/*@ensures \result != NULL && pq_empty(\result); @*/ ;

void pq_add(pq_t Q, elem x)     //O(log n)
/*@requires Q != NULL; @*/
/*@ensures  !pq_empty(Q); @*/ ;

elem pq_rem(pq_t Q)         //O(log n)
/*@requires Q != NULL && !pq_empty(Q); @*/
```

3. Describe all the heap invariants in detail.

4. Draw all the min-heaps with elements 1,2,3,4.

5. The worst case cost of inserting an element in a min-heap already containing n elements is $O(\log(n))$. What is the cost (in big-O) of inserting p elements one by one in a min-heap? (Hint: check Stirling's approximation from wikipedia)