University of Nevada, Las Vegas Computer Science 477/677 Spring 2025
Assignment 3: Due Saturday February 8, 2025

Name:_____

You are permitted to work in groups, get help from others, read books, and use the internet.
To turn in the homework, follow instructions given by the teaching assistant, Sabrina Wallace.

1. Give the names of three kinds of priority queue.

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2. In any programming application, The items of a priority queue represent ------------------------------

   -------------------------------.

3. *Pop* and **push** are operators of the ADT -------------------------------.

4. *Fetch* and **store** are operators of the ADT -------------------------------.

5. The answer to each of these questions is either **bubbleup** or **bubbledown**.

   If a heap is implemented a binary tree:

   (a) Insertion into the heap requires the use of -------------------------------.

   (b) Deletmax (or deletemin, as the case may be) reuquires use of -------------------------------.

6. The following is C++ code for which quadratic time sorting algorithm?

```
int x[N];

void swap(int x, int y)
 {
  int temp = x;
  x = y;
  y = temp;
 }

void sort()
 {
  for(int i = 0; i < N; i++)
   for(int j = i+1; j < N; j++)
    if(x[j] < x[i]) swap(x[i],x[j]);
 }
```

7. The following is C++ code for a function that computes a floating point number to the power of a positive integer. Find a loop invariant which can be used to prove correctness of the function.

```cpp
float power(float x, int n) // input condition: n > 0
 {
  assert(n > 0);
  float z = 1.0;
  float y = x;
  int m = n;
  while(m > 0)
   {
    if(m%2) z = y*z;
    y = y*y;
    m = m/2;
   }
  return z;
 }
```

8. We can experimentally analyze the time complexity of code by using a counter. In the following example, we count the number of iterations of the loop.

```cpp
cout << "Enter a positive integer" << endl;
int n;
cin >> n;
int kount = 0;
for(int i = 0; i < n; i++)
 kount++;
cout << "kount = " << kount << endl;
```

Of course, the output will be n. We can say that the time complexity of the code is $\Theta(n)$.

For each of the code fragments below, find the asymptotic time complexity in terms of n. Assume that the value of n is given.

(a) `for(int i = 1; i < n; i=2*i)`

(b) `for(int i = n; i > 1; i=i/2)`

(c) `for(int i = 1; i < n; i++)`
      `for(int j = 1; j < i; j = j*2)`

(d) `for(int i = 1; i < n; i++)`
      `for(int j = i; j < n; j = j*2)`

(e) `for(int i = 1; i*i < n; i++)`

9. Create a treap with the following itmes, each with the priority shown in the table. Use min-heap order.

item	priority
V	3
A	5
S	6
Q	4
N	7
K	2