CS2223
HW#3

DUE: Thursday, November 15

1 (8 points) ***a*** Let *T* be an unsorted array of *n* integers. Give an algorithm to find a pair $x, y \in T$ which maximizes $|x - y|$. If $T = (6,13,19,3,8)$, then *x*=19 and *y*=3 would be a solution. The worst case execution time of your algorithm must be in $O(n)$.
b Let *T* be a sorted array of *n* integers. Give an algorithm to find a pair $x, y \in T$ which maximizes $|x - y|$. If $T = (3,6,8,13,19)$, then *x*=3 and *y*=19 would be a solution. The worst case execution time of your algorithm must be in $O(1)$.
c Let *T* be an unsorted array of *n* integers. Give an algorithm to find a number *x* which doesn't appear in *T*. If $T = (6,13,19,3,8)$, then *x*=5 be a solution. The worst case execution time of your algorithm must be in $O(n)$.
d Let *T* be a sorted array of *n* integers. Give an algorithm to find a pair $x, y \in T$ which minimizes $|x - y|$. If $T = (3,6,8,13,19)$, then *x*=6 and *y*=8 would be a solution. The worst case execution time of your algorithm must be in $O(n)$.

2. (4 points) From Baase and Van Gelder's *Computer Algorithms*

Suppose an algorithm does m^2 steps on an array of *m* elements (for any $m \geq 1$). The algorithm is to be used on two arrays A_1 and A_2 (separately). The arrays contain a total of *n* elements. A_1 has *k* elements and A_2 has *n-k* elements ($0 \leq k \leq n$).

For what value(s) of *k* will the most work be done? For what value(s) of *k* will the least work be done? Justify your answers. (Remember that an example is not a proof. There is a good solution for this problem using simple calculus.)

3. (16 points) Write programs to implement a (min)-priority queue using each of the following data structures:

- Ordered array
- Unordered array
- Binary search tree
- Heap

Actually, you only need programs to implement *construct* and *insert*. For each implementation, estimate the average time to *insert n* elements into an empty priority queue. Describe the implementation you use, and show results supporting your estimate.