First Name: Last Name:

Q1: Read the instructions for question Q1 in the assignment document. **For each of the three sub-questions, write your answer to the question in the given space**.

(a): After the extract-max operation, we have

A[1]=

A[2]=

A[3]=

A[5]=

A[10]=

(b): After the increase-key operation, we have

A[1]=

A[2]=

A[3]=

A[5]=

A[10]=

(c): After the insertion operation, we have

A[1]=

A[2]=

A[3]=

A[5]=

A[11]=

Q2: Read the instructions for question Q2 in the assignment document. **For each of the three sub-questions, write your answer to the question in the given space**.

(a): After the extract-min operation, we have

A[1]=

A[2]=

A[3]=

A[4]=

A[8]=

(b): After the decrease-key operation, we have

A[1]=

A[2]=

A[3]=

A[4]=

A[9]=

(c): After the insertion operation, we have

A[1]=

A[2]=

A[3]=

A[5]=

A[11]=

Q3: Read the instructions for question Q3 in the assignment document. **For each of the three sub-questions, write your answer to the question in the given space**.

(a): After performing union(16, 4), we have

A[1]=

A[4]=

A[9]=

A[15]=

A[16]=

(b): After performing union(6, 14), we have

A[1]=

A[6]=

A[9]=

A[14]=

A[15]=

(c): After performing find-set(7) and find-set(15), we have

A[1]= ☐

A[7]= ☐

A[8]= ☐

A[9]= ☐

A[15]= ☐

Q4: Read the instructions for question Q4 in the question document. **For each of the eight sub-questions, check the box that most accurately describes the corresponding time complexity**.

(a):

- ☐ $O(\log n)$
- ☐ $\Omega(\log n)$
- ☐ $\Theta(\log n)$
- ☐ $O(n)$
- ☐ $\Omega(n)$
- ☐ $\Theta(n)$
- ☐ $O(n \log n)$
- ☐ $\Omega(n \log n)$
- ☐ $\Theta(n \log n)$
- ☐ None of the above

(b):
- [ ] $O(\log n)$
- [ ] $\Omega(\log n)$
- [ ] $\Theta(\log n)$
- [ ] $O(n)$
- [ ] $\Omega(n)$
- [ ] $\Theta(n)$
- [ ] $O(n \log n)$
- [ ] $\Omega(n \log n)$
- [ ] $\Theta(n \log n)$
- [ ] $\Theta(1)$

(c):
- [ ] $O(\log n)$
- [ ] $\Omega(\log n)$
- [ ] $\Theta(\log n)$
- [ ] $O(n)$
- [ ] $\Omega(n)$
- [ ] $\Theta(n)$
- [ ] $O(n \log n)$
- [ ] $\Omega(n \log n)$
- [ ] $\Theta(n \log n)$
- [ ] $\Theta(1)$

(d):
- [ ] $O(\log n)$
- [ ] $\Omega(\log n)$
- [ ] $\Theta(\log n)$
- [ ] $O(n)$
- [ ] $\Omega(n)$
- [ ] $\Theta(n)$
- [ ] $O(n \log n)$
- [ ] $\Omega(n \log n)$
- [ ] $\Theta(n \log n)$
- [ ] $\Theta(1)$

(e):
- [ ] $O(\log n)$
- [ ] $\Omega(\log n)$
- [ ] $\Theta(\log n)$
- [ ] $O(n)$
- [ ] $\Omega(n)$
- [ ] $\Theta(n)$
- [ ] $O(n \log n)$
- [ ] $\Omega(n \log n)$
- [ ] $\Theta(n \log n)$
- [ ] $\Theta(1)$

(f):
- ☐ $O(\log n)$
- ☐ $\Omega(\log n)$
- ☐ $\Theta(\log n)$
- ☐ $O(n)$
- ☐ $\Omega(n)$
- ☐ $\Theta(n)$
- ☐ $O(n \log n)$
- ☐ $\Omega(n \log n)$
- ☐ $\Theta(n \log n)$
- ☐ $\Theta(1)$

(g):
- ☐ $O(\log n)$
- ☐ $\Omega(\log n)$
- ☐ $\Theta(\log n)$
- ☐ $O(n)$
- ☐ $\Omega(n)$
- ☐ $\Theta(n)$
- ☐ $O(n \log n)$
- ☐ $\Omega(n \log n)$
- ☐ $\Theta(n \log n)$
- ☐ $\Theta(1)$

(h):
- ☐ $O(m)$
- ☐ $\Omega(m)$
- ☐ $\Theta(m)$
- ☐ $O(m \log n)$
- ☐ $\Omega(m \log n)$
- ☐ $\Theta(m \log n)$
- ☐ $O(m\alpha(m,n))$, where $\alpha(m,n)$ is the inverse Ackermann function.