Exam 2

Due Apr 15 at 11:59pm **Points** 24 **Questions** 24
Available Apr 13 at 12:01am - May 3 at 11:59pm **Time Limit** 60 Minutes

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	54 minutes	15 out of 24

Correct answers will be available Apr 16 at 12:01am - Apr 21 at 12am.

Score for this quiz: **15** out of 24
Submitted Apr 15 at 8:40pm
This attempt took 54 minutes.

Incorrect

Question 1

0 / 1 pts

Consider a binary max-heap implemented using an array. Which one of the following array represents a binary max-heap?

- 25,14,12,13,10,8,16
- (selected) 25,12,16,13,10,8,14
- 25,12,16,13,10,8,14
- 25,14,16,13,10,8,12

Question 2

1 / 1 pts

Which of the following Binary Min Heap operation has the highest time complexity?

1> Merging with another heap under the assumption that the heap has capacity to accommodate items of other heap
2> Deleting an item from heap
3> Decreasing value of a key

4> Inserting an item under the assumption that the heap has capacity to accommodate one more item

- 1
- 2
- 3
- 4

Incorrect

Question 3

0 / 1 pts

A 3-ary max heap is like a binary max heap, but instead of 2 children, nodes have 3 children. A 3-ary heap can be represented by an array as follows: The root is stored in the first location, a[0], nodes in the next level, from left to right, is stored from a[1] to a[3]. The nodes from the second level of the tree from left to right are stored from a[4] location onward. An item x can be inserted into a 3-ary heap containing n items by placing x in the location a[n] and pushing it up the tree to satisfy the heap property.

Which one of the following is a valid sequence of elements in an array representing 3-ary max heap?
(A) 1, 3, 5, 6, 8, 9
(B) 9, 6, 3, 1, 8, 5
(C) 9, 3, 6, 8, 5, 1
(D) 9, 5, 6, 8, 3, 1

- ○ D
- ○ A
- ○ C
- ◉ B

Question 4

1 / 1 pts

In a binary max heap containing n numbers, the smallest element can be found in time

(A) 0(n)
(B) O(logn)
(C) 0(loglogn)
(D) 0(1)

- ◉ A
- ○ C
- ○ D
- ○ B

Question 5

1 / 1 pts

A Data Structure does the following operation:

1. **push(s, x)** operation's step are described below:
   - Enqueue x to q2
   - One by one dequeue everything from q1 and enqueue to q2.

- Swap the names of q1 and q2

2. **pop(s)** operation's function are described below:
   - Dequeue an item from q1 and return it

This data structure performs as a :

- Linked List
- Stack
- Cannot be Determined
- Queue

Question 6

1 / 1 pts

A priority queue can efficiently implemented using which of the following data structures? Assume that the number of insert and peek (operation to see the current highest priority item) and extraction (remove the highest priority item) operations are almost same.
(A) Array
(B) Linked List
(C) Heap Data Structures like Binary Heap, Fibonacci Heap
(D) None of the above

- A
- D
- B
- C

Incorrect

Question 7

0 / 1 pts

Consider the following operation along with Enqueue and Dequeue operations on
queues, where k is a global parameter.

```
MultiDequeue(Q){
   m = k
   while (Q is not empty and m  > 0) {
      Dequeue(Q)
      m = m - 1
   }
}
```

What is the worst case time complexity of a sequence of n MultiDequeue() operations on an initially empty queue?
(A) $\Theta(n)$
(B) $\Theta(n+k)$
(C) $\Theta(nk)$
(D) $\Theta(n^2)$

- C
- D
- B
- A

Question 8

1 / 1 pts

Which of the following algorithms can be used to most efficiently determine the presence of a cycle in a given graph ?
(A) Depth First Search
(B) Breadth First Search
(C) Prim’s Minimum Spanning Tree Algorithm
(D) Kruskal’ Minimum Spanning Tree Algorithm

- A

C

B

D

Incorrect

Question 9

0 / 1 pts

Breadth First Search (BFS) is started on a binary tree beginning from the root vertex. There is a vertex t at a distance four from the root. If t is the n-th vertex in this BFS traversal, then the maximum possible value of n is

____

[This Question was originally a Fill-in-the-blanks Question]

(A) 15
(B) 16
(C) 31
(D) 32

D

A

C

B

Incorrect

Question 10

0 / 1 pts

The number of possible min-heaps containing each value from {1, 2, 3, 4, 5, 6, 7} exactly once is ______

- 210
- 8
- 80
- 20 (selected)

Question 11

1 / 1 pts

Which of the following is not O(n^2)?
(A) (15^10) * n + 12099
(B) n^1.98
(C) n^3 / (sqrt(n))
(D) (2^20) * n

- C (selected)
- D
- B
- A

Incorrect

Question 12

0 / 1 pts

Which of the given options provides the increasing order of asymptotic complexity of functions f1, f2, f3 and f4?

```
  f1(n) = 2^n
  f2(n) = n^(3/2)
  f3(n) = nLogn
  f4(n) = n^(Logn)
(A) f3, f2, f4, f1
(B) f3, f2, f1, f4
(C) f2, f3, f1, f4
```

```
(D) f2, f3, f4, f1
```

- C
- A
- B
- D

Incorrect

Question 13

0 / 1 pts

A single array A[1..MAXSIZE] is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables top1 and top 2 (top1< top 2) point to the location of the topmost element in each of the stacks. If the space is to be used efficiently, the condition for “stack full” is

- top1 + top2 = MAXSIZE
- (top1 = MAXSIZE/2) or (top2 = MAXSIZE)
- top1 = top2 -1
- (top1 = MAXSIZE/2) and (top2 = MAXSIZE/2+1)

Question 14

1 / 1 pts

A queue is implemented using an array such that ENQUEUE and DEQUEUE operations are performed efficiently. Which one of the following statements is **CORRECT** (n refers to the number of items in the queue)?
A>Both operations can be performed in $O(1)$time

B>At most one operation can be performed in $O(1)$ time but the worst case time for the other operation will be $\Omega(n)$
C>The worst case time complexity for both operations will be $\Omega(n)$
D>Worst case time complexity for both operations will be $\Omega(\log n)$
2

- B
- D
- C
- A

Question 15

1 / 1 pts

What is the time complexity of Dijkstra's Algorithm on a graph with n nodes and m edges but which does *not* utilize a priority queue but instead does a search through all nodes and their edges to find the next closest node at each algorithm step?

- **O(m*n)**
- **O(m)**
- **O(n)**
- **O(m log n)**

Question 16

1 / 1 pts

Using a priority queue, Dijstra's Algorithm may put each node into the priority queue multiple times.

- ◯ False
- ◉ True

Question 17

1 / 1 pts

Given a sequence A = [3, 2, 4, 1, 5]. How many inversions does A have?

- ◯ 3
- ◯ 2
- ◯ 1
- ◉ 4

Incorrect

Question 18

0 / 1 pts

Given a boolean 2D matrix with m row and n column, find the number of islands. A group of connected 1s forms an island.

mat = [[1, 1, 0, 0, 1],

[1, 1, 0, 0, 0],

[0, 1, 0, 1, 1],

[0, 0, 0, 0, 0],

[1, 1, 0, 0, 1]]

How many islands in the above graph?

- 5
- 4
- 6
- 7

Question 19

1 / 1 pts

Given a boolean 2D matrix with m row and n column, find the number of islands. A group of connected 1s forms an island. This includes the situation where 1s are juxtaposed diagonally. So, for example, the matrix below contains 5 islands.

mat =

[[1, 1, 0, 0, 1],

[1, 1, 0, 0, 0],

[0, 1, 0, 1, 1],

[0, 0, 0, 0, 0],

[1, 1, 0, 0, 1]]

We can use __ to get the number of islands:

- Only DFS
- Neither BFS or DFS
- Either BFS or DFS
- only BFS

Question 20

1 / 1 pts

Given a boolean 2D matrix with m row and n column, find the number of islands. A group of connected 1s forms an island. This includes the situation where 1s are juxtaposed diagonally. So, for example, the matrix below contains 5 islands.

mat =

[[1, 1, 0, 0, 1],

[1, 1, 0, 0, 0],

[0, 1, 0, 1, 1],

[0, 0, 0, 0, 0],

[1, 1, 0, 0, 1]]

What is the time complexity to get the number of islands with a graph search algorithm?

- (selected) O(m*n)
- O(max(m,n))
- O(m+n)
- O(m*m*n*n)

Question 21

1 / 1 pts

Any function T(·) satisfying the following recurrence relation:

T (n) ≤ 2 T (n / 2) + c n

when n > 2, and

T (2) ≤ c (1)

is bounded by __________ , when n > 1.

- O(n2 log n)
- O(n log n2)
- O(n log n) (selected)
- none of these

Question 22

1 / 1 pts

Any function T(·) satisfying the following:

T (n) ≤ q T (n / 2) + c n

when n > 2, and

T (2) ≤ c (base case)

is bounded by __________ , where q > 2.

- *$O\ (n^{\log_q 2})$*

- ( ) $O(n^{\log_2 q})$
- ( ) $O(q^{\log_2 n})$
- ( ) none of these

Question 23

1 / 1 pts

A schedule of interval requests contains an inversion if it contains two requests i and j such that:

- ( ) i is scheduled before j but $d_j < d_i$
- ( ) i is scheduled after j and $d_j = d_i$
- ( ) i is scheduled before j but $d_j = d_i$
- ( ) i is scheduled after j but $d_j < d_i$

Incorrect

Question 24

0 / 1 pts

For a graph with m edges and n nodes, the total runtime of Dijkstra's algorithm using a priority queue is:

- [x] O(m log mn)
- [ ] O(n log m)
- [ ] O(n log mn)
- [ ] O(m log n)

Quiz Score: **15** out of 24