

Final Exam

Due May 4, 2022 at 6:30pm

Points 100

Questions 20

Available May 4, 2022 at 4pm - May 4, 2022 at 6:30pm 2 hours and 30 minutes

Time Limit 150 Minutes

This quiz is no longer available as the course has been concluded.

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	37 minutes	87 out of 100

Score for this quiz: **87** out of 100

Submitted May 4, 2022 at 4:36pm

This attempt took 37 minutes.

Question 1

5 / 5 pts

If the array [1,5,3,2,4] would to be sort using the insertion sort algorithm taught in the lectures (Check the slides of chapter 1), how many How many times will "A[i+1] = A[i]" and "A[i+1] = key" be executed?

Correct!

7

Correct Answers

7 (with margin: 0.1)

4 (with margin: 0.1)

8 (with margin: 0.1)

Question 2

3 / 3 pts

What is the average time complexity of the merge sort algorithm?

- ☐ $O(n)$
- ☐ $O(\log n)$
- ☒ $O(n \cdot \log n)$
- ☐ $O(n^2)$

Correct!

Question 3

9 / 9 pts

Given the following pairs of $g(x)$ and $f(x)$, which of them satisfies the relation $g(x) = O(f(x))$?

- ☐ $g(x)=n^2, f(x) = n \cdot (\log n)^2$
- ☒ $g(x)=x \cdot (2^x), f(x) = 3^x$
- ☐ $g(x)=n^2, f(x) = n \cdot \log n$
- ☐ $g(x)=n^2, f(x) = n$

Correct!

Question 4

5 / 5 pts

Please solve for the complexity function $T(n)$ of the following recursive relation using substitution method:

$$T(n) = T(n-1) + n - 1, n > 1$$

$$T(1) = 1, n = 1$$

Which of the following is the correct answer?

Correct!

☒ $T(n) = \Theta(n^2)$

☐ $T(n) = \Theta(n \log n)$

☐ $T(n) = \Theta(\log n)$

☐ $T(n) = \Theta(n^2 \log n)$

Question 5

1 / 1 pts

If we were to solve the following recursive relation using the recursion tree method, which of the followings should be the height of the recursion tree? (In other words, how many levels will there be in the corresponding recursion tree?)

\lg indicates logarithm with base 2.

$$T(n) = 3(T(n/2)) + 1, n > 1$$

$$T(1) = 1, n = 1$$

☐ n^2

☐ $3n$

☐ $3^{\lg n}$

☒ $\lg n$

Correct!

Question 6

9 / 9 pts

Which of the following recursive relations cannot be solved using master theorem?

☐ $T(n) = 3 \cdot T(n/2) + n^2$

☐ $T(n) = 16T(n/4) + n!$

☐ $T(n) = 4 \cdot T(n/2) + n^2$

☒ $T(n) = 2 \cdot T(n/2) + n/\log n$

Correct!

Question 7

5 / 5 pts

if the binary search algorithm is applied to the following sorted array to find the element 5, how many elements needs to be checked in total ? (Including checking the element 5 in the final round)

1, 2, 3, 4, 5, 6, 7

3

Correct!

Correct Answers

3 (with margin: 0.1)

Question 8

0 / 5 pts

If we were to apply the "partition" algorithm in the slides to the following array, using the first element as the pivot, how many exchanges in total will be performed? (Hint: The total number of "exchange $A[i], A[j]$ " and "exchange $A[p], A[i]$ " being executed)

Array : [3,5,1,2,4,6,0]

Note that we are talking about only applying the partition algorithm once, not fully sort the array. I remember some of you did that instead in assignment 2.

You Answered

2

Correct Answers

4 (with margin: 0.1)

Question 9

3 / 3 pts

What is the worst case complexity of the quicksort algorithm?

- ☐ $O(\log n)$
- ☐ $O(n)$
- ☐ $O(n \cdot \log n)$
- ☒ $O(n^2)$

Correct!

Question 10

0 / 3 pts

What is the minimum height of a decision tree that is capable of sorting n elements?

- ☐ n^2
- ☐ n
- ☐ $n \cdot \log n$

Correct Answer

You Answered

☒ $\log n$

Question 11

0 / 5 pts

If the radix sort algorithm were to be applied to sort the following array ascendingly, what would be the first element in the array **after** the first iteration of the algorithm?

171, 45, 75, 90, 802, 24, 2, 66

You Answered

171

Correct Answers

90 (with margin: 0.1)

Question 12

3 / 3 pts

Let A be the adjacency matrix of an undirected and unweighted graph G (In which all edge weights are treated as 1).

If all of the elements of A sum up to 64, how many edges are there in the graph G ?

Correct!

32

Correct Answers

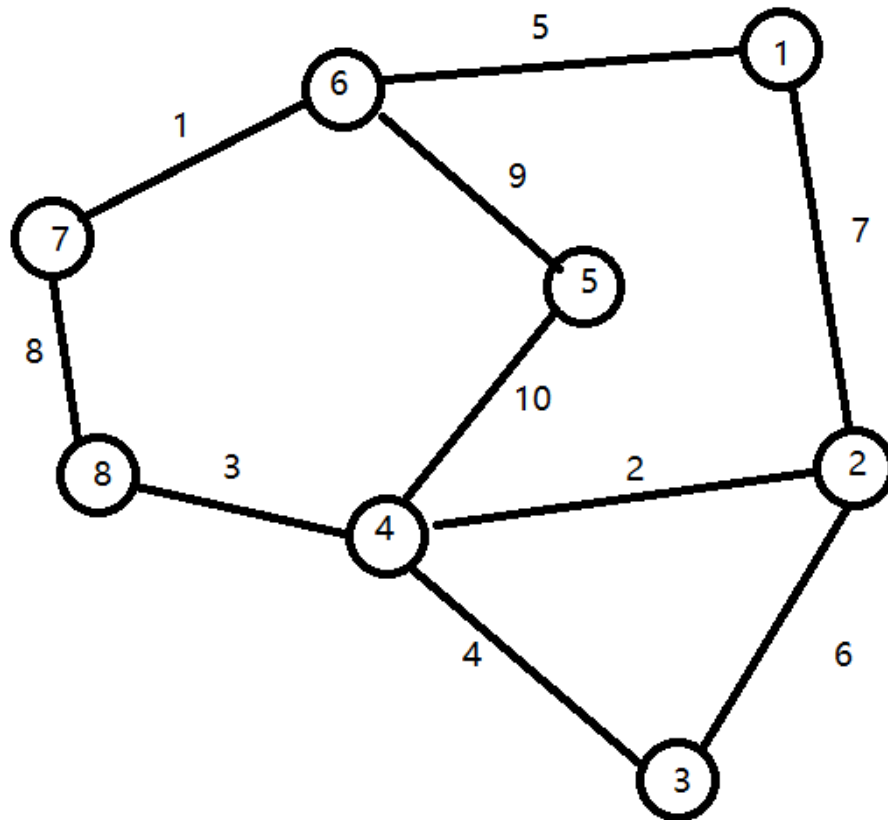
32 (with margin: 0.1)

Question 13

8 / 8 pts

Please solve for the MST of the following graph using Prim's algorithm, using node 1 as the starting node.

Which of the follow edges will **NOT** be adopted in the MST?



☐ 3-4

☐ 4-8

☐ 1-6

☒ 2-3

☐ 1-2

☐ 5-6

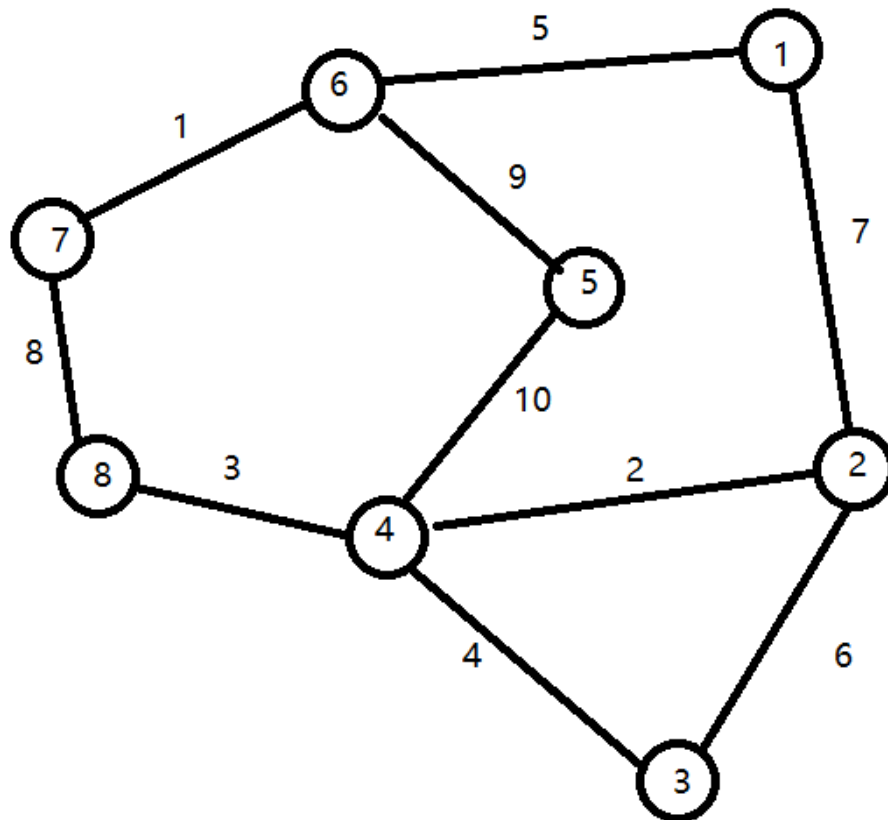
Correct!

Question 14

8 / 8 pts

Given the following graph, if Dijkstra's algorithm were to be applied to it using node 1 as the source node,

which node will be selected as the result of Extract-Min(Q) in the 4th iteration? (Starting from the first iteration selecting node 1)



Correct!

2

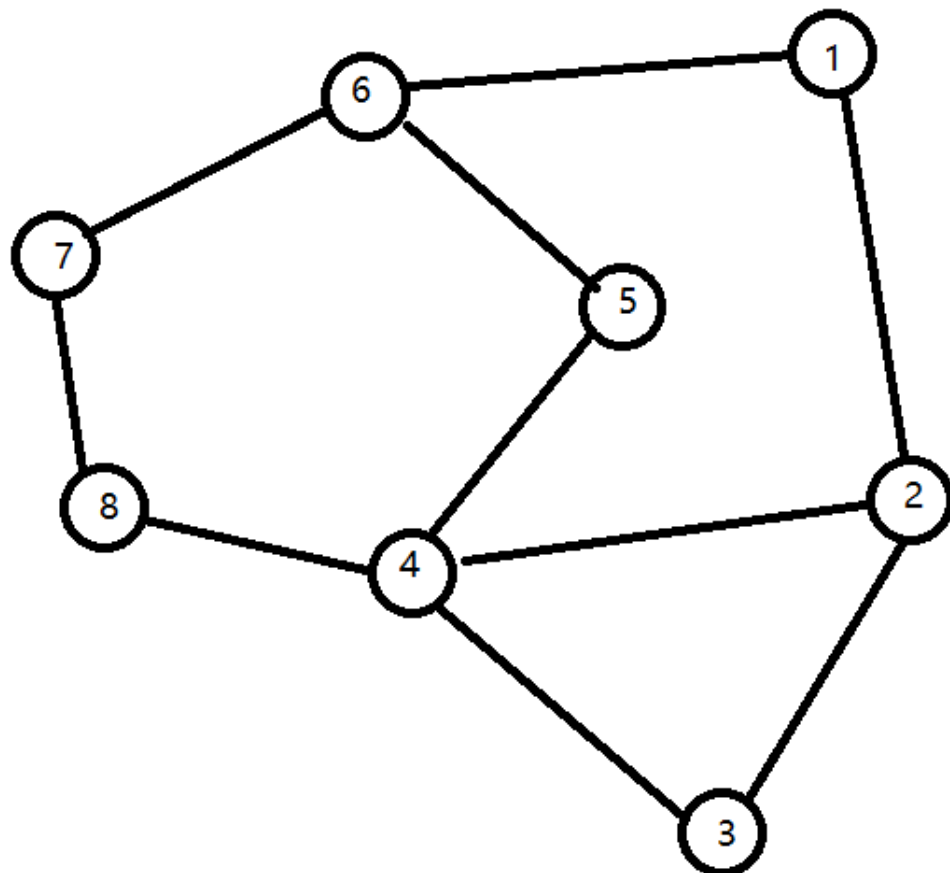
Correct Answers

2 (with margin: 0.1)

Question 15

8 / 8 pts

Given the following weightless / non-directional graph, if BFS algorithm were to be applied to traverse it starting from node 1, which node will be the last one to be visited?



Correct!

Correct Answers

8 (with margin: 0.1)

Question 16

3 / 3 pts

Let G be a graph, with V be the number of its vertices and E be the number of its edges.

What is complexity of the BFS algorithm?

Correct!

- ☐ $O(|E|)$
- ☐ $O(|V|)$
- ☐ $O(|V| * |E|)$
- ☒ $O(|V| + |E|)$

Question 17**5 / 5 pts**

Given a graph G with 12 vertices, how many iterations does Bellman-Ford algorithm need before it can fully determine whether negative-weight cycle exist?

(One iteration refers to a round of relaxing every edge in the graph)

Correct!

12

Correct Answers

12 (with margin: 0.1)
11 (with margin: 0.1)

Question 18**3 / 3 pts**

What is the time complexity of Floyd-Warshall algorithm?

Correct!

- ☒ $O(n^3)$
- ☐ $O(n)$
- ☐ $O(n * \log n)$

☐ $O(n^2)$

Question 19**4 / 4 pts**

If $P = NP$ is proven to be true in the future, then which of the follow statement is **not necessarily** true?

☐ All P questions can be solved in polynomial time

☐ All NP-complete questions can be solved in polynomial time

☒ All P questions can be solved in linear time

☐ All NP questions can be solved in polynomial time

Correct!**Question 20****5 / 5 pts**

Given a problem A, if A is NP-Complete, then which of the following statement is **not necessarily** true?

☐ A is NP

☒ A is P

☐ The existence of a polynomial time solution to A implies the existence of polynomial time solution to all problems in P and NP

☐ A possible solution to A is verifiable in polynomial time

Correct!

Quiz Score: **87** out of 100