Published Preview Edit

Week 12 Quiz

Plagiarism declaration

By submitting work for this quiz I hereby declare that I understand the University's policy on academic integrity (https://academicintegrity.unimelb.edu.au/) and that the work submitted is original and solely my work, and that I have not been assisted by any other person (collusion) apart from where the submitted work is for a designated collaborative task, in which case the individual contributions are indicated. I also declare that I have not used any sources without proper acknowledgment (plagiarism). Where the submitted work is a computer program or code, I further declare that any copied code is declared in comments identifying the source at the start of the program or in a header file, that comments inline identify the start and end of the copied code, and that any modifications to code sources elsewhere are commented upon as to the nature of the modification.

This is a preview of the draft version of the quiz.

You should attempt the quiz after the lecture and your tutorial.

- The quiz is available for a period of 10 days.
- You may attempt the quiz multiple times (if you happen to get a question wrong, you can do it again)
- Your score on the quiz will be recorded in the grade book. The score is not used when determining your final mark in this subject
- The quiz might not display equations correctly in some browsers. If you experience problems, we recommend that you use Firefox.

Quiz Type	Graded Quiz
Points	7
Assignment Group	Imported Assignments
Shuffle Answers	No
Time Limit	No Time Limit
Multiple Attempts	Yes
Score to Keep	Highest
Attempts	Unlimited
View Responses	Always
Show Correct Answers	Immediately
One Question at a Time	No

Due	For	Available from	Until
-	Everyone	-	-

Preview

Score for this attempt: **7** out of 7
Submitted Sep 25 at 11:47
This attempt took 1 minute.

Question 1

1 / 1 pts

How many different binary search trees (BSTs) with elements {1,2,3,4} are there? And how many with elements {1,2,3,4,5}?

- 24 and 120, respectively
- **Correct!** 14 and 42, respectively
- 16 and 25, respectively
- 14 and 72, respectively

10 and 24, respectively

Correct! It is easy to see that there are 5 different BSTs with elements {1,2,3}. Now for {1,2,3,4}, there are 5 BSTs with root 1 (because there are 5 BSTs with elements {2,3,4}). Similarly there are 5 with root 4. There can only be 2 with root 2, because the left subtree has only 1 in it, and the right subtree has {2,3}. Similarly there are 2 with root 3, for a total of 14. So we have:

B(0) = 1 (1 empty BST)
B(1) = 1 (1 BST with 1 element)
B(2) = 2 (2 BSTs with 2 elements)
B(3) = 5 (5 BSTs with 3 elements)
B(4) = 14 (namely 5 + 2 + 2 + 5)

More generally, B(n+1) = B(0)B(n) + B(1)B(n-1) + B(2)B(n-2) + ... + B(n-2)B(2) + B(n-1)B(1) + B(n)B(0). Why?

Question 2

1 / 1 pts

A complete binary tree containing 100 nodes has height 6, that is, a longest path from the root to a leaf has length 6.

How many of its nodes are at the maximal distance from the root?

Correct!

37

rrect Answers

37 (with margin: 0)

Yes, too easy!

Question 3

1 / 1 pts

Each line below gives the contents of an array that represents a complete binary tree. Identify all the cases in which that binary tree is a max-heap.

Correct! - [x] 9 8 2 5 7 1 0 4 3 6

- [ ] 9 8 6 5 4 7 3 2 1 0

Correct! - [x] 9 8 6 5 7 1 4 3 2 0

Correct! - [x] 9 8 6 4 7 1 0 3 2 5

Correct! - [x] 9 8 7 6 5 4 3 2 1 0

Yes, indeed. All but one.

Question 4

1 / 1 pts

What is the worst case time complexity of merge sort?

- ( ) $O(n^2)$

Correct! - (•) $O(n \log n)$

- $O(n)$
- $O(\log n)$

Question 5

1 / 1 pts

Given an unsorted array of n integers, what is the worst case time complexity of constructing the corresponding max-heap using the bottom-up method and then applying heapsort to the resulting max-heap? Please select the tightest Big-O bound of those listed below.

Correct!

- O(n log n)
- O(log n)
- O(n)
- O(n^2)

The worst case complexity of constructing the max-heap via the bottom-up method is O(n). The worst case complexity of applying heapsort to the max-heap is O(n log n). Consequently, the worst case complexity of the construction and the subsequent heapsort is O(n log n).

Question 6

1 / 1 pts

An algorithm takes a set of inputs and performs calculations on it. The output from the algorithm consists of a set of numbers and letters that are related to the initial inputs. The output from the algorithm can be verified in worst case O(n^2) time. This algorithm is:

Correct!

- (selected) Decidable and in complexity class NP
- Undecidable and in complexity class NP
- Decidable and in complexity class P and not in complexity class NP
- Undecidable and in complexity class P and not in complexity class NP

Well done: checking is easy, but generating the solution is more challenging.

Question 7

1 / 1 pts

When considering different types of algorithms, which one of the following statements is true?

Correct!

- (selected) Brute-force algorithms can never be faster than a well-designed greedy algorithm for the same problem.
- Divide and conquer algorithms are always faster than greedy algorithms for the same problem

- Greedy algorithms are always faster than divide and conquer algorithms for the same problem

- Greedy algorithms give good approximate answers to problems, but never the best possible answer.

Quiz Score: **7** out of 7