Reading Quiz #1

ⓘ This is a preview of the published version of the quiz

Started: Sep 11 at 10:32p.m.

Quiz Instructions

Read **this document on the Stable Matching problem (https://www.students.cs.ubc.ca/~cs-320/2022W1/handouts/stable-matching.pdf)** , as well as sections 2.1 to 2.4 from the required text *Algorithm Design* by Kleinberg and Tardos. The three textbook sections contain review material from CPSC 221. You can attempt this quiz **three** times.

Question 1 — 1 pts

Which of these can be used as a "measure of progress" for the Gale-Shapley algorithm (with employers making job offers) because it happens on each iteration of the loop?

- ○ A student improves the "rating" of the employer by which they're hired.
- ○ An employer previously looking for a student is removed from the free list of employers (i.e., hires a student)
- ○ An employer fills their position by hiring a student.
- ○ The iteration variable's value increases by 1
- ○ An employer offers a job to a student it has never made an offer to before

Question 2 — 1 pts

Which of the following statement(s) is/are true about the Gale-Shapley algorithm (with employers making job offers)?

- ☐ Once an employer has hired a student, this employer's position remains filled for the remainder of the execution of the algorithm.
- ☐ If a student is hired by the first employer on their preference list at some point in the execution of the algorithm, then the last employer on their preference list has not yet made them an offer..
- ☐ Once a student has a job, they will remain hired for the remainder of the execution of the algorithm.
- ☐ If an employer is paired with the first student on their preference list at some point in the execution of the algorithm, then this employer has not yet made an offer to the last student on its preference list.
- ☐ It is possible for every employer and student to be paired with their top choice.

Question 3 — 1 pts

Assume that you have a very slow computer that performs 1000 operations per second. Also, assume that you only have 30 minutes to run an algorithm on a dataset, and that the algorithm performs $n \log_2 n$ operations for inputs of size n. Which of the following is the size of the largest dataset that you can give the algorithm to obtain a result within your time limit of 30 minutes?

- ○ 10^7
- ○ 10^4
- ○ 10^5
- ○ 10^6

Question 4 — 1 pts

Which of the following is/are true?

- ☐ $O(n \log n) = O(n)$
- ☐ $O(2^n) = O(3^n)$
- ☐ $O(n^2 + n) = O(n^2)$
- ☐ $O(2^n + n) = O(2^n)$
- ☐ $O(3n + 100) = O(n)$
- ☐ $O(n\,2^n) = O(2^n)$

Question 5 — 1 pts

Which of the following can be done in $O(n)$? (We have no pre-assumptions about the data we are given.)

- ☐ Running Gale-Shapley to solve the stable matching problem when we have n employers and n students.
- ☐ Merging two ascending arrays of size n to build a new ascending array.
- ☐ Inserting an element into a descending array of size n and building a new descending array.
- ☐ Sorting an array of n elements.

Question 6 — 1 pts

What is the time complexity of function f()? (Feel free to check this
Link **(https://www.youtube.com/watch?v=PQBY99p7A4g&list=PLpdsoCzoYBF_bt_rqgslbMyeiqCcDPWFL)**

(https://www.youtube.com/watch?v=PQBY99p7A4g&list=PLpdsoCzoYBF_bt_rqgslbMyeiqCcDPWFL)
)

```
int f(int n)
{
  int counter = 0;
  for(int i = 0; i < n; i++)
     for (int j = i; j > 0; j--)
```

```
        counter += 1;
    return counter;
}
```

- $\Theta(n^2)$
- $\Theta(n)$
- $\Theta(n \log n)$
- $\Theta(\log n)$

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