

Q1 Stable Matching Instance

2 Points

Consider an instance of the stable matching problem with n jobs and n candidates. Which of the following are true?

Q1.1

1 Point

Each job has an ordered list of all the candidates.

- True
- False

Explanation

This is true by definition.

Q1.2

1 Point

The total size of all the job lists combined is $(n - 1)^2$.

- True
- False

Explanation

There are n jobs, where each has a list with n candidates, so the total size is n^2 .

Q2 Stable Matching

4 Points

Q2.1

1 Point

A matching is a set of pairs (x, y) where x is a job and y is a candidate, and no two pairs in the set share a common job or candidate.

- True
- False

Explanation

This true by the definition of a matching.

Q2.2

1 Point

In a matching, a job can appear in more than one pair.

- True
- False

Explanation

No. The main property of the matching is that each job and candidate appear exactly once.

Q2.3

1 Point

A rogue couple is a job j and a candidate c who both prefer each other over their partners in the matching.

True

False

Explanation

This is the definition of a rogue couple.

Q2.4

1 Point

Pairing each job to its favorite candidate (i.e. the candidate at the top of its preference list) results in a stable matching.

True

False

Explanation

Not true. This may not be a matching as every job may have the same favorite candidate.

Q3 Propose and Reject

4 Points

For the propose and reject algorithm with jobs proposing, which of the following is true?

Q3.1

1 Point

The algorithm can finish in 1 day.

True

False

Explanation

If every job has a different favorite candidate, then after one day, every candidate has received a proposal and the algorithm terminates.

Q3.2

1 Point

If a candidate has a job on their string, they will continue to have a job offer in hand, every day after that.

True

False

Explanation

True. This is due to the fact that once a candidate has a job in their hand, the job has to keep coming back until they are replaced on the candidate's string. This is also a consequence of the improvement lemma.

Q3.3

1 Point

The propose and reject algorithm always terminates with a stable matching.

- True
- False

Explanation

See the notes for a proof of this fact.

Q3.4

1 Point

The matching produced by this algorithm will always be candidate-optimal.

- True
- False

Explanation

False; the propose and reject algorithm with jobs proposing will always be job-optimal, and candidate pessimal.