International Computer Science Competition

Example Problems (Qualification Round)

Example Problem 1

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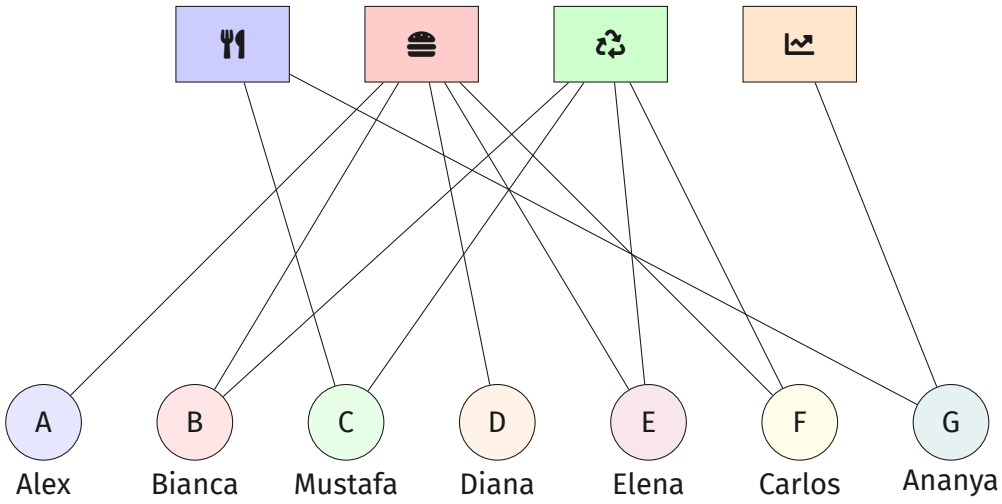
Alex, Bianca, Mustafa, Diana, Elena, Carlos, and Ananya have applied for open positions in a restaurant. The open positions are server (🍴), chef (🍔), cleaner (♻), and manager (📈):

Each person can only do the jobs shown in the graph below. Every job needs one person, and each person can only have one job.



Question 1: Which one of the following is definitely true?

a) Elena will be hired as the cleaner.

b) Bianca will be hired as the chef.

c) Mustafa will be hired as the server.

Question 2: Which one of the following cannot be true?

a) Alex is hired as the chef and Bianca is hired as the cleaner.

b) Ananya is hired as the manager and Mustafa is hired as the cleaner.

c) Mustafa is hired as the server and Carlos is hired as the chef.

</> Example Problem 2

Below you can find a description of `Algorithm A` in pseudocode.

Algorithm A

Input: Number of points $numPoints > 0$
Output: For you to find out.

1: $pointsInCircle \leftarrow 0$
2: **for** $i \leftarrow 1$ to $numPoints$ **do**
3: $x \leftarrow$ random number between -1 and 1
4: $y \leftarrow$ random number between -1 and 1
5: **if** $x^2 + y^2 \leq 1$ **then**
6: $pointsInCircle \leftarrow pointsInCircle + 1$
7: **end if**
8: **end for**
9: **return** $4 \times \frac{pointsInCircle}{numPoints}$

The algorithm has the following specification:

- `numPoints`: An integer larger than 0.
- The function should return a double precision floating-point.

Implement the pseudocode as a running program. Then, explain in words what the algorithm computes and how it works. Be sure to include both your code and your written explanation in your solution.

Tip: To produce random numbers, you can use the Python module `random`, the C++ library `<random>`, or `java.util.random` for Java.