Exercises 1
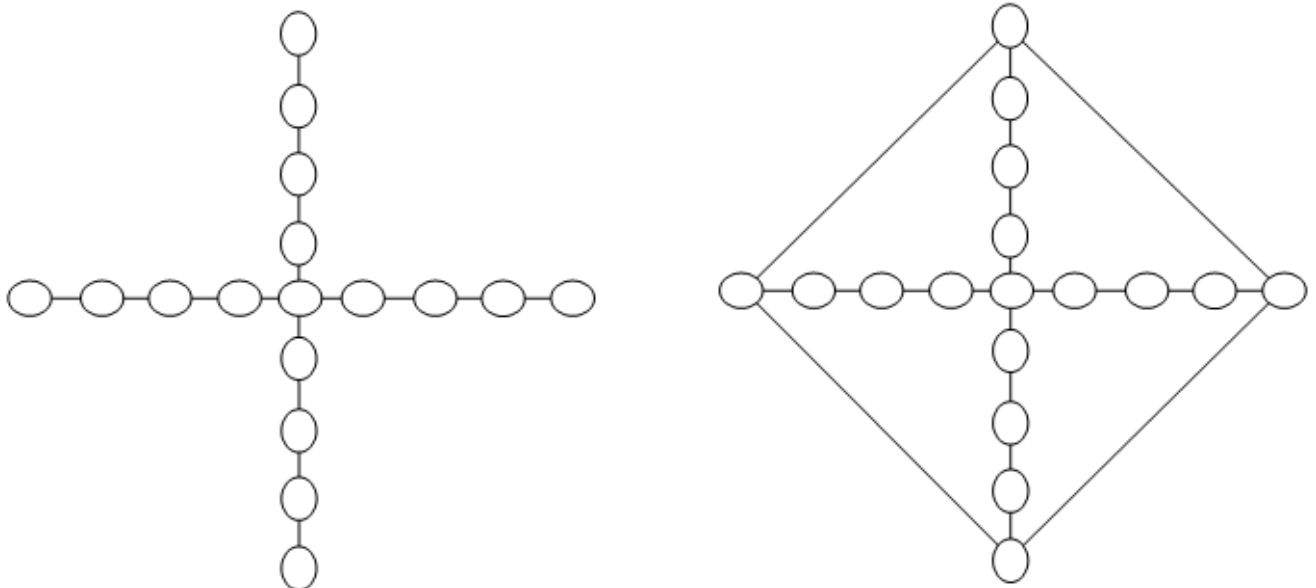
Task 1.1. The Best Score

I have *N* exam sheets, graded with scores 0⋯100. Now I want to find a student who got the best score. Several (*M*) friends promised to help to find the best-graded sheet quickly. How can I organize our work efficiently? Explain the algorithm.

Task 1.2. Topology Experiment

We have two computer networks, each consisting of 17 computers. "Basic" network (on the left) is connected as a star. "Advanced" network (on the right) has an additional cable connection between the outermost computers. The signal, sent from any computer to any of its directly cable-connected neighbors, reaches its destination in 5 milliseconds.

Your task is to write a Java program that calculates the average travel time of a signal inside each of these networks. The program randomly selects two distinct computers in the network and calculates how much time a signal travels between them. After 5000 experiments the program should report the results according to the following format:

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basic network: N milliseconds, advanced network: M milliseconds.
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Task 1.3. Embarrassing Parallelism

A problem is called *embarrassingly parallel* if it is can be divided into subtasks requiring little or no communication. In other words, embarrassingly parallel problems are very easy to parallelize.

Which of the following problems are embarrassingly parallel?

a. Sorting an array.
b. Rotating a wireframe 3D object.
c. Compressing files into independent archives.
d. Finding the shortest path between two graph vertices.
e. Brute-force password cracking.

Task 1.4. Network Features

Among the network topologies we considered, which one

a. Is the most expensive to setup in terms of equipment costs?
b. Has the highest (i.e., slowest) worst-case message delivery time?
c. Corresponds to a small home network, where all devices are directly connected to the main router?