The Blindern Problem

The Blindern problem is a challenge known to many students at the University of Oslo. This challenge arises when students must move from one lecture to another on the opposite side of campus in just under fifteen minutes. You have been asked to consult on UiO's new project where a tunnel system is to be developed connecting all buildings belonging to the campus.

It has already been mapped out how much it will cost to dig tunnels between each pair of buildings (and assume that none of the outlined tunnels will collide). Your task is to find the most cost-effective way to construct a tunnel system, based on the outlined tunnels, such that one can move between all buildings solely by using the tunnel system.

(a) Briefly explain how this problem could be expressed as a graph problem. Your answer should include:

- What type of graph (directed/undirected and weighted/unweighted) is suitable here?
- What do the nodes represent?
- What do the edges represent?

(b) Provide a suitable algorithm, known from the curriculum, which can be used to find the most cost-effective way to excavate a tunnel system so that one can move between all buildings solely by using the tunnel system. For the algorithm, state:

- the most central data structures it uses,
- a *short* explanation of how the algorithm works, and
- the runtime complexity of the algorithm.

(c) The project is completed in record time and is ready for use. Describe, in natural language, an efficient algorithm for finding the shortest path from one building to another using only the tunnel system. You can use algorithms known from the curriculum *without* having to explain them. State the runtime complexity of the algorithm.