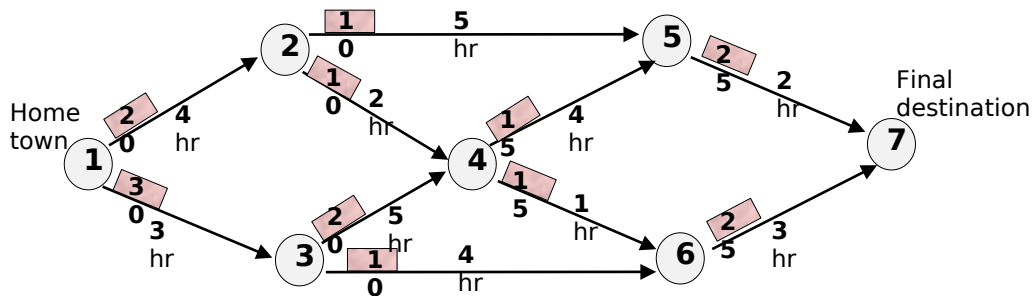


A Circus Team Travelling Problem:

The diagram below represents a road network in which circles represent seven towns numbered 1, 2, 3,..., 7; and the arrow from town i to j represents the direct road link from town i to town j, for each $i, j = 1, 2, \dots, 7$.



A **circus team of 50 members** is travelling from their home **town 1** to perform circus in **town 7**. On a particular Saturday morning, the team leaves their home town 1 at **6:00 AM** in two groups: one group of 20 members traveled to town 2 and the other group of 30 members traveled to town 3. In each of the next towns, each group will be regrouped into sub-teams and travel along each of the subsequent road links to the next towns for commercial purpose. At each town, busses are waiting to take the sub-teams to the next towns. A rectangle on a road link represents the bus assigned to take a sub-team along the road link; and the number in the rectangle is the number of team members that must be taken by the bus. The other number along a road link is the duration (time in hours) that the bus needs to travel along the road link.

A bus can leave (start traveling) from its waiting location as soon as all team members assigned to it are on board (arrived). No bus can leave its waiting location before all team members assigned to it are arrived. The circus performance starts as soon as **all the fifty members** of the team have arrived at town 7.

Questions: (Provide appropriate reason for each of your answers)

- What is the earliest time at which a bus can leave (start traveling) from town 2, from town 3, 4, 5, and 6?
- What is the earliest time at which the circus performance can start at town **7**?
- The busses of which road links must travel on time without any delay in order to start the performance at the earliest possible time?
- How long can the following busses delayed without affecting the earliest start time of the performance?
 - The bus from town 2 to 4
 - The bus from town 4 to 5
 - The bus from town 4 to 6
- Is it possible to start the performance at 6:00 PM (12 hours after the departure from home town) if the busses obey the travel times? If this is not possible, then the busses of which road links should be considered to speed up beyond the given travel times in order to start the performance at 6:00 PM?

