Train Dispatch

- The definition is left vague on purpose.
  - Your job is to figure out how to implement this well.
  - Be creative!
- Train Dispatch System
  - Design a system to can route trains from location to location.
  - The train system consists of an undirected weithted graph where edges represent tracks and nodes represent stations/ yards.
  - The tracks are bidirectional (undirected) but trains cannot cross on the track.
    - You may however decide on routing several trains on a track if they are going on the same direction.
  - You will measure the performance of your system compared to a base line

Train Dispatch

- Motivation
  - Trains are at the core of any transportation network. In many countries such as the ones in Europe, rail handles the majority of passenger travel. In the US, rail is no less important with trains being used for freight.
- What is the goal
  - There are millions to be made in train optimization. Your group needs to make sure you beat a very crude algorithm for routing trains.
    - What is the advantage of your proposed approach compared to the baseline? What makes your train control (dispatch) smarter?
  - Your system has to at least:
    - Take schedules of trains consisting of a series of triples (source, destination, time) and schedule trains accordingly
    - Measure the performance based on at least
      - How long does it take for you to route every single train?
      - What was average delay for each train? Note that despite the schedule time (in the triple above), you may not be able to route the train because the tracks are being used.
    - The system takes the schedule and starts counting time. It stops counting time when all trains are routed.
    - You should defined a concept of time. You can use real time or an abstract notion of time (preferred).
    - Note that the track weights represent the time it takes for a train to traverse that track. You can also make the weights represent the distance and use speed of train to calculate time of track.

BioComplex

Train Dispatch

- Questions you should be thinking about (not limited to these)
  - Are you being fair to the baseline?
    - Your system cannot beat the baseline because it has different assumptions such as station capacity, etc.
  - Can you handle trains of different type? Based on some priority?
    - Passenger, Freight, Dangerous Cargo, etc.
  - Can your system handle track failures? What happens if a track is out of service?
  - Careful with deadlocks!!
  - How would you represent your graphs.
    - Remember that you have a multi-graph. I.e. two nodes have have more than one edge linking them (see picture)
  - What size should be the schedule?
    - I suggest you generate several different train networks (graphs) and try many different schedule sizes.
      - 100 trains, 200 trains
  - Note that I'm not assuming you have the notion of a day.
    - Your program gets a schedule with a number of trains to be routed (source, destination, time) and outputs the route that each train will take (path from source destination, time it was routed)
  - Should you have a visualization? Yes!!!!
    - For this project a visualization is required!
  - Tracks have costs, but you could also have a cost per train.
    - How long is a train? This information is important to know how many trains you can fit in one track on the same direction.

Submission

- Submission instructions are available on the set of slides entitled "01-Intro"
- What should you submit
  - All the code necessary to run your program
  - A PDF document that contains:
    - A theoretical description of your algorithm
    - Charts demonstrating the performance of your system.
      - Be creative!
    - A section describing what each member of the group has done in the project.
    - A timeline (per week) of what has been developed in that week
  - A PDF of your presentation
- In addition to the submission, we'll have demos in the lab.
  - April 23 and 28
- Note that this project is more complex than the elevator so you should start working on this today!!

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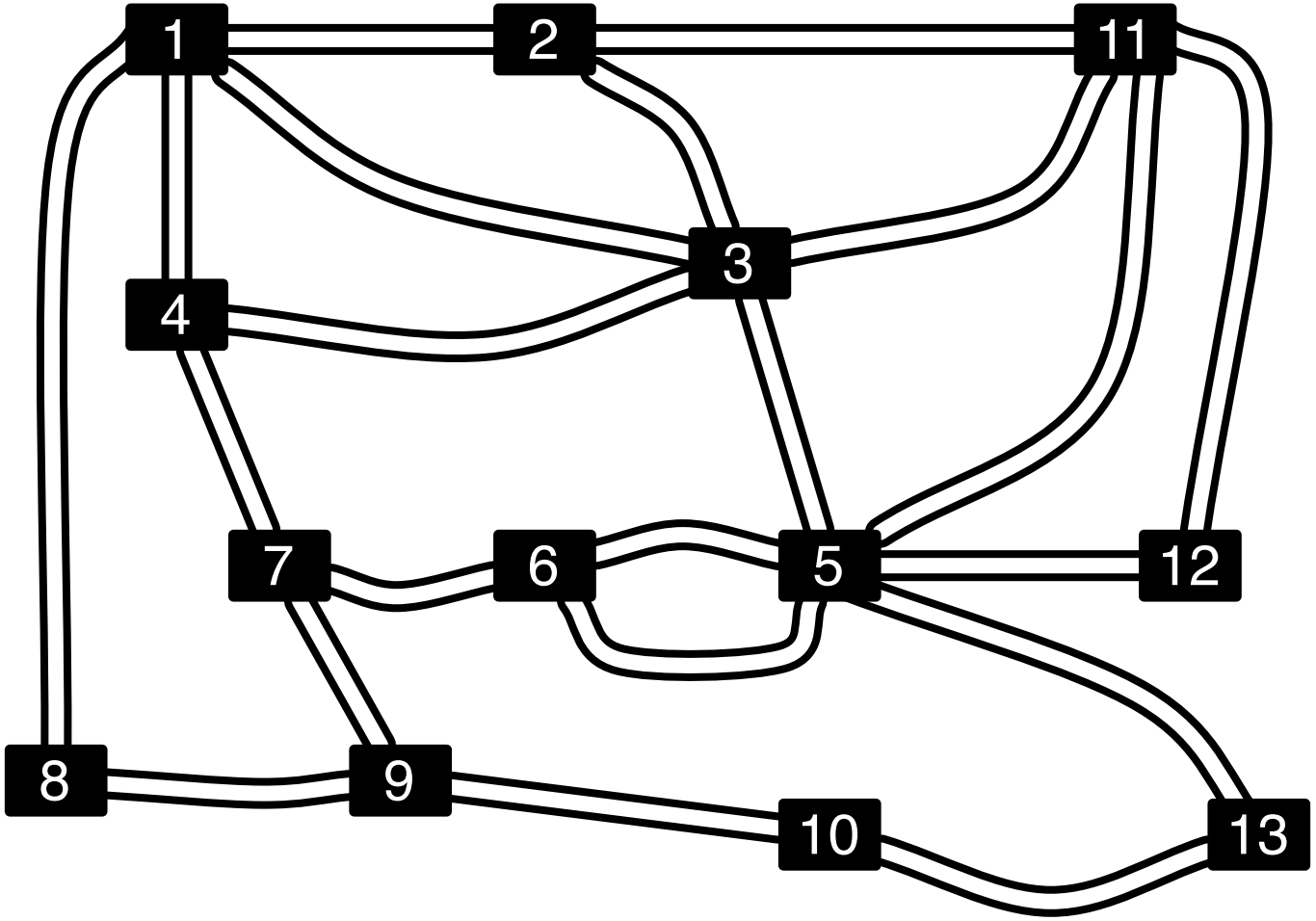
Example of Baseline



Schedule
(7,12,1)
(1,5,2)
(1,6,3)

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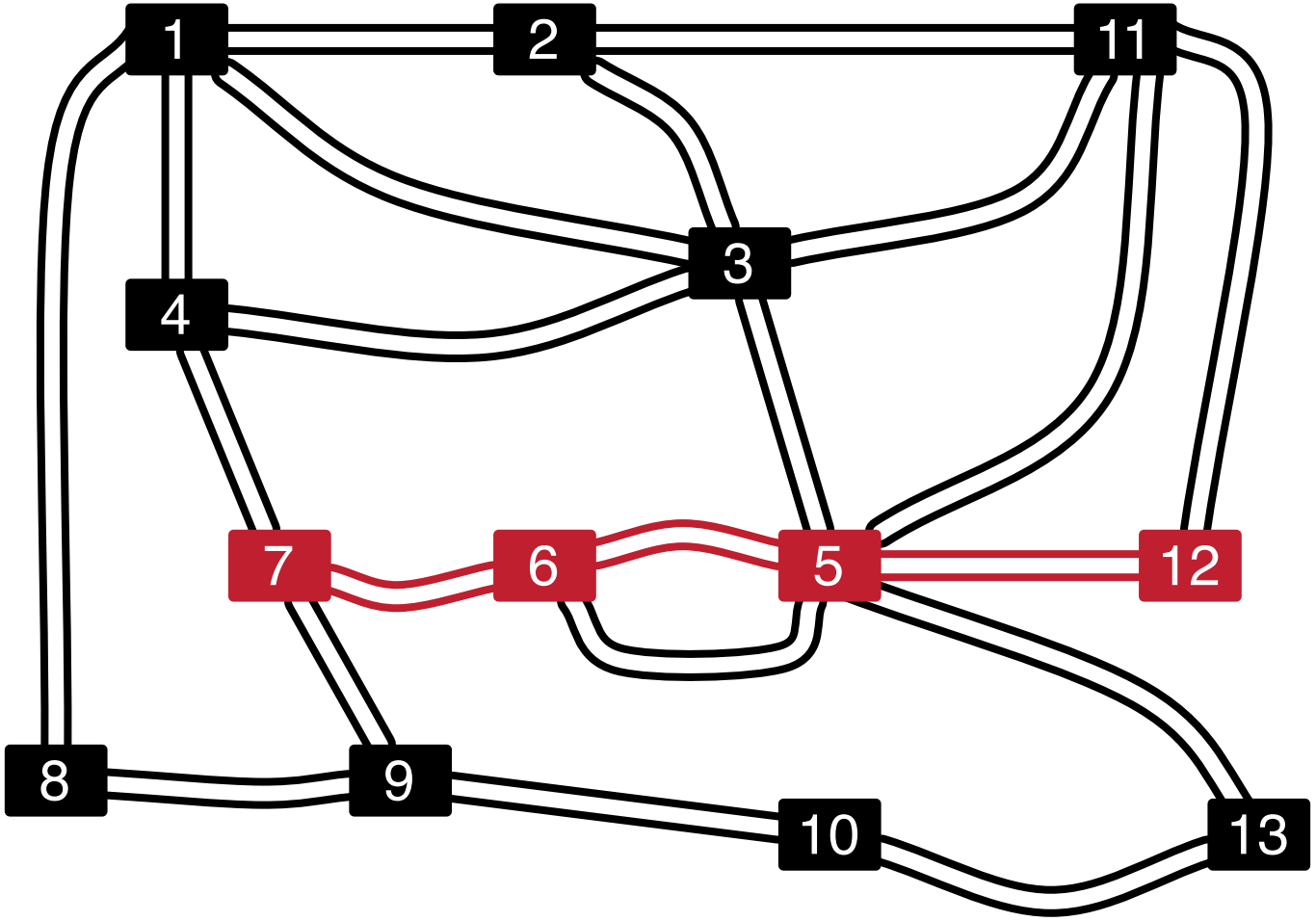
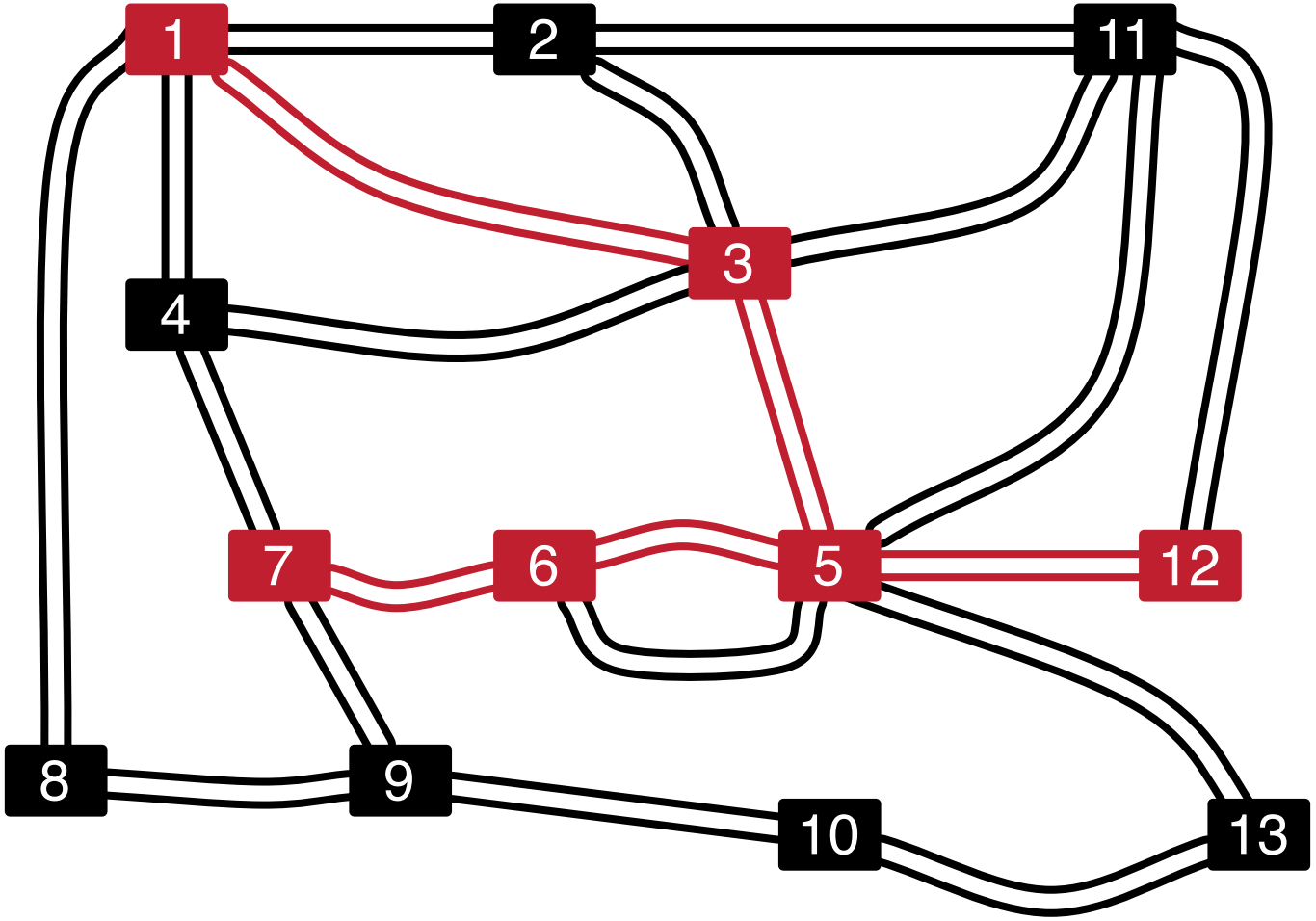
Example of Baseline



Schedule
(7,12,1)
(1,5,2)
(1,6,3)

Example of Baseline



Schedule
(7,12,1)
(1,5,2)
(1,6,3)

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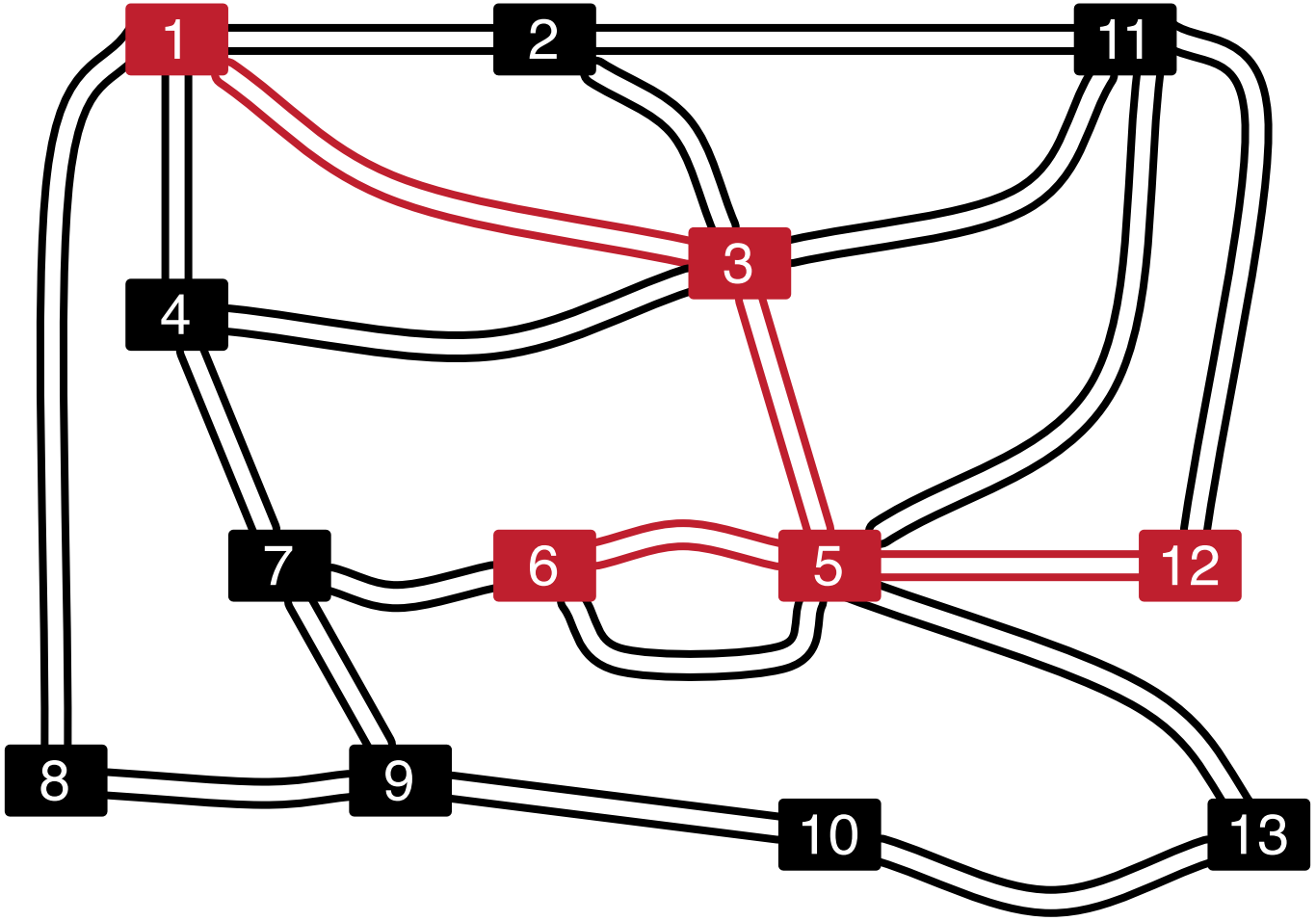
Example of Baseline



Schedule
(7,12,1)
(1,5,2)
(1,6,3) waiting…

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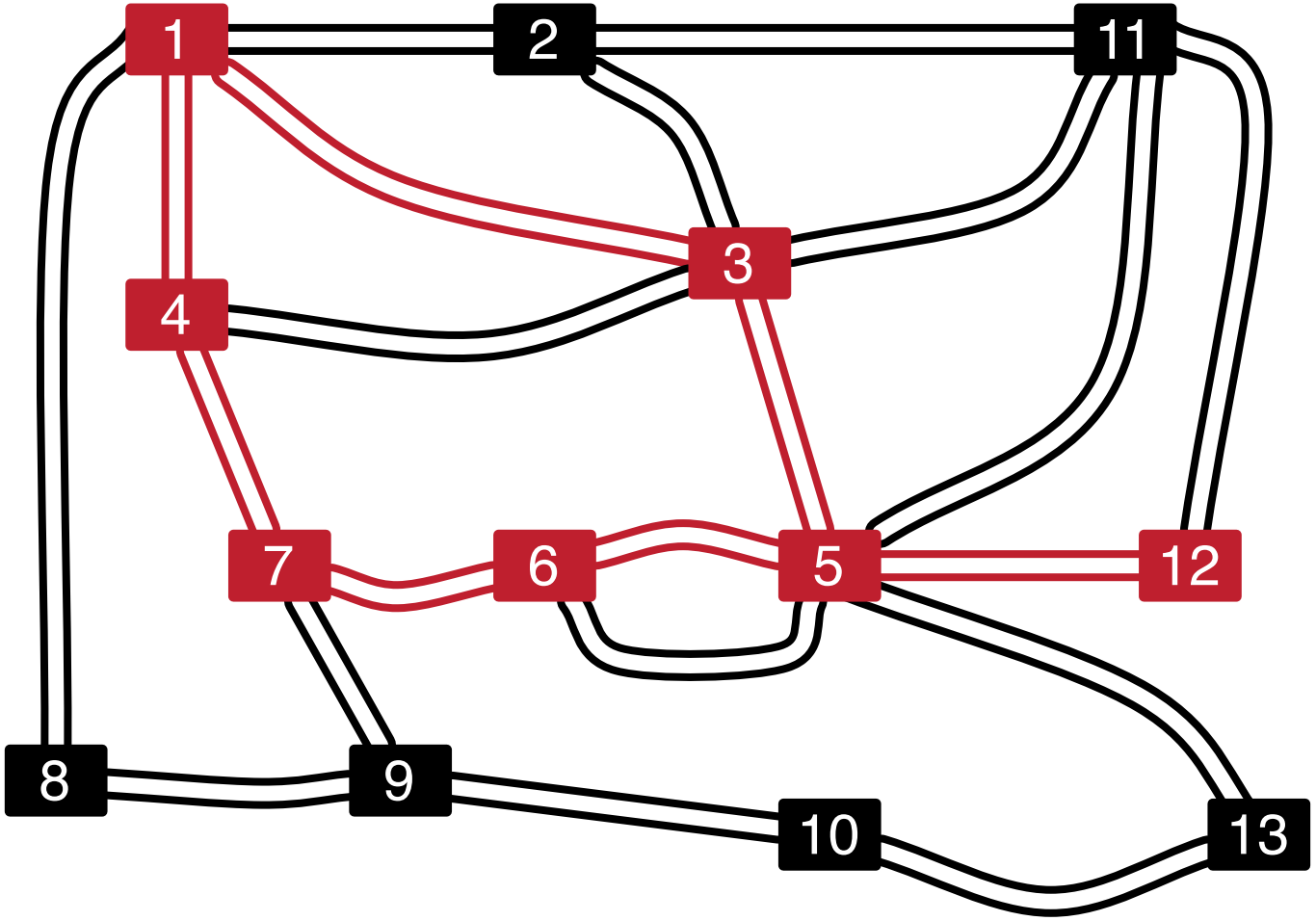
Example of Baseline



Schedule
(7,12,1)
(1,5,2)
(1,6,3)

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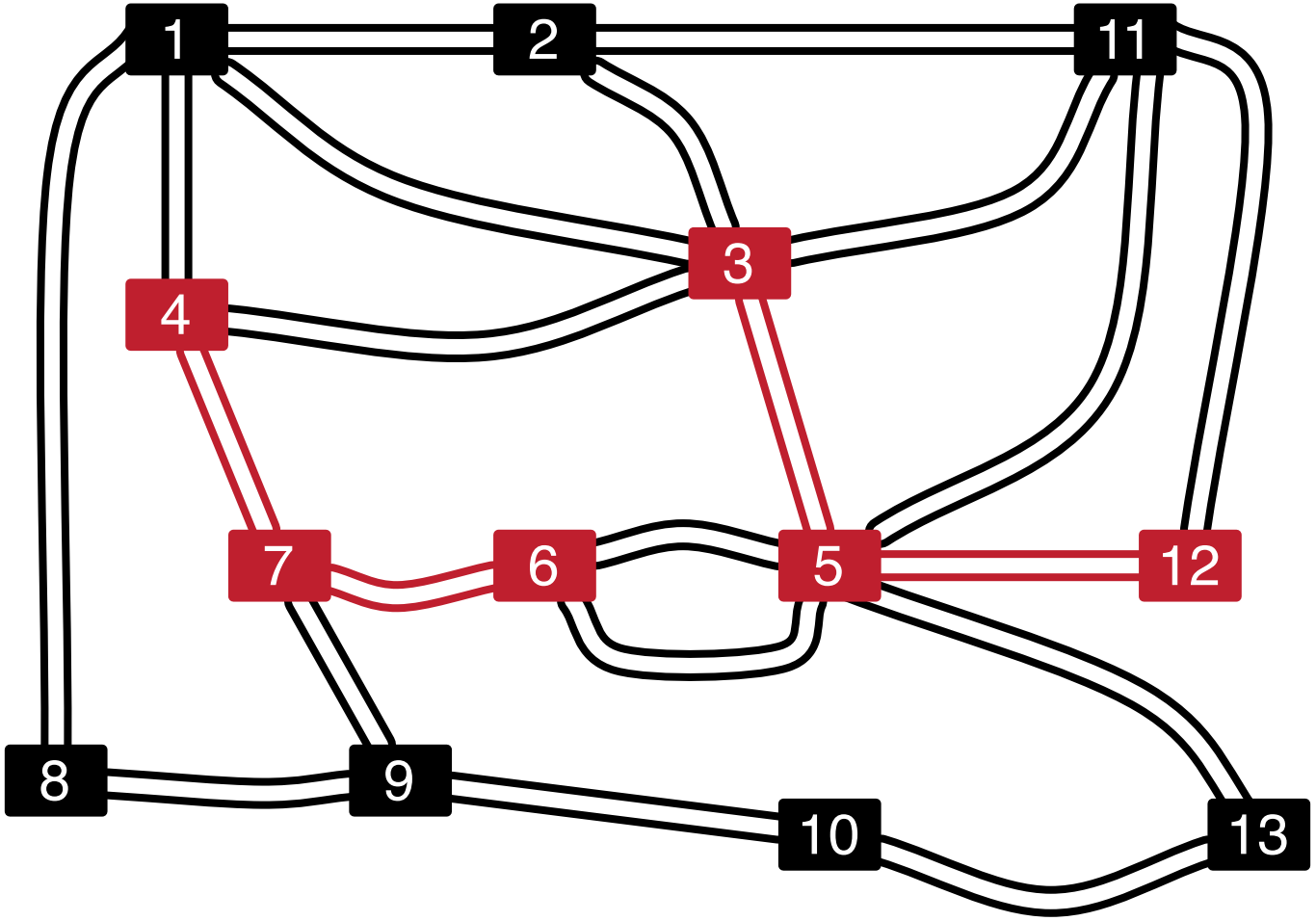
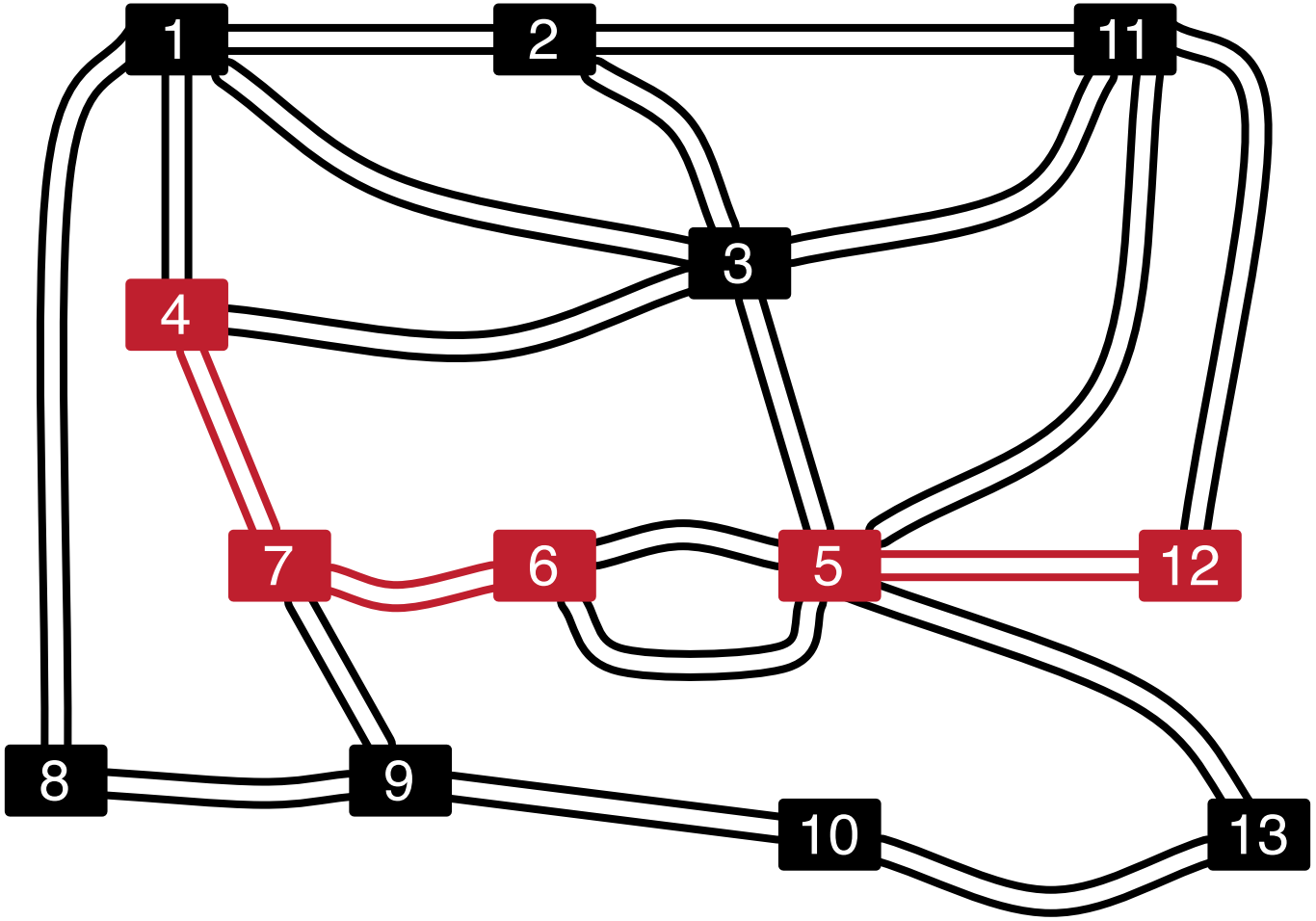
Example of Baseline



Schedule
(7,12,1)
(1,5,2)
(1,6,3)

BioComplex

Example of Baseline



Schedule
(7,12,1)
(1,5,2) Arrived
(1,6,3)

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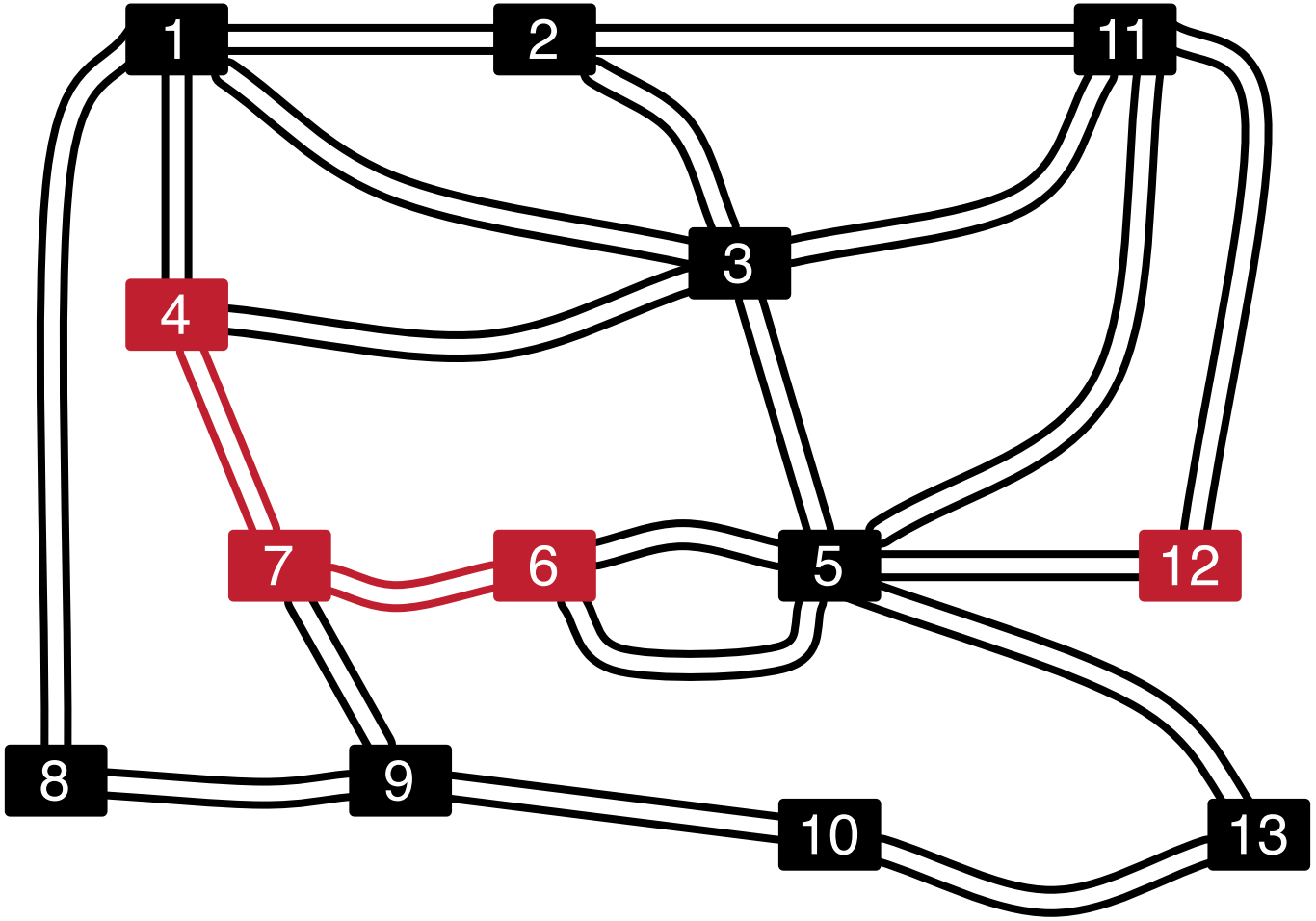
Example of Baseline



Schedule
(7,12,1) Arrived
(1,5,2) Arrived
(1,6,3)

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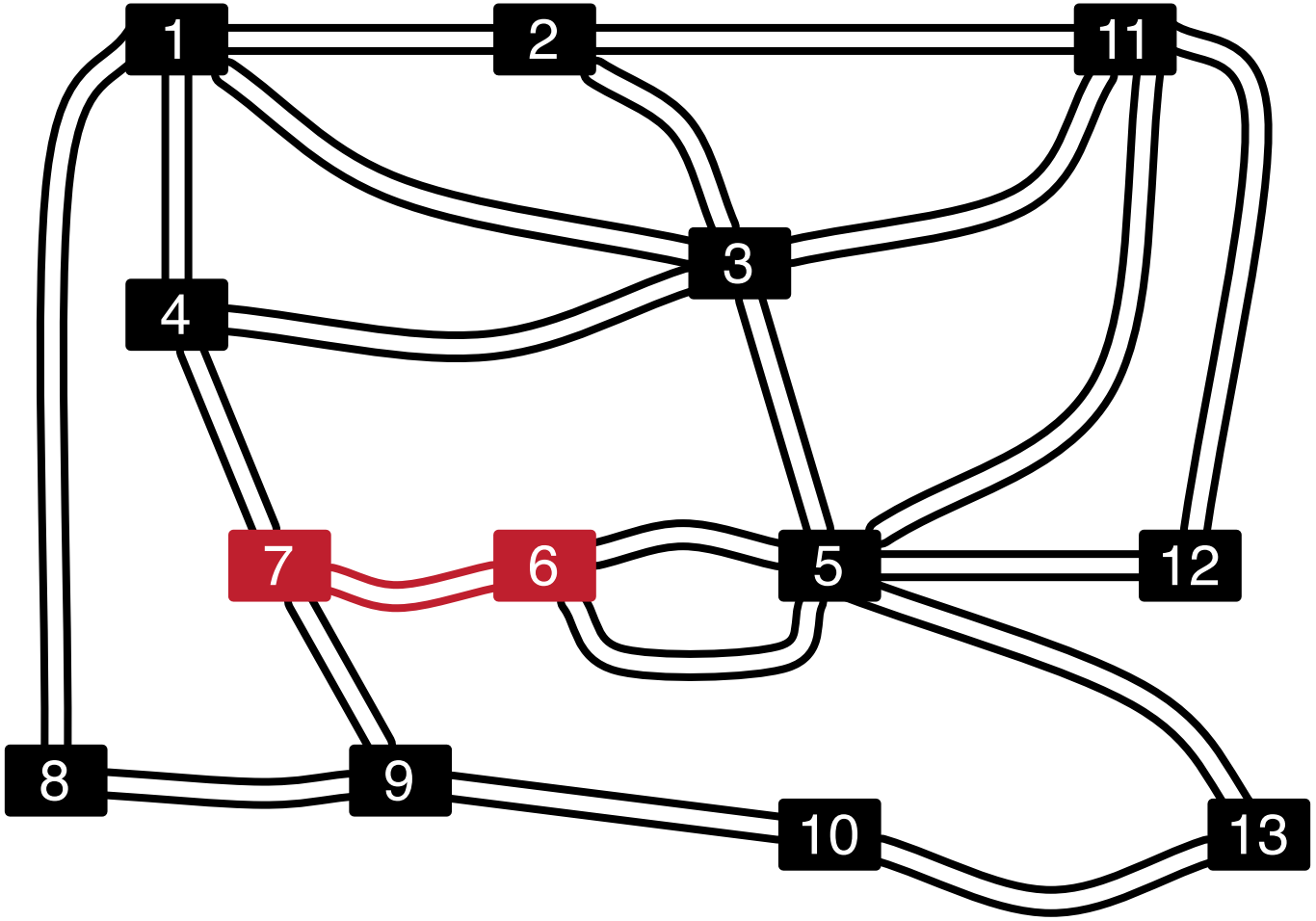
Example of Baseline



Schedule
(7,12,1) Arrived
(1,5,2) Arrived
(1,6,3)

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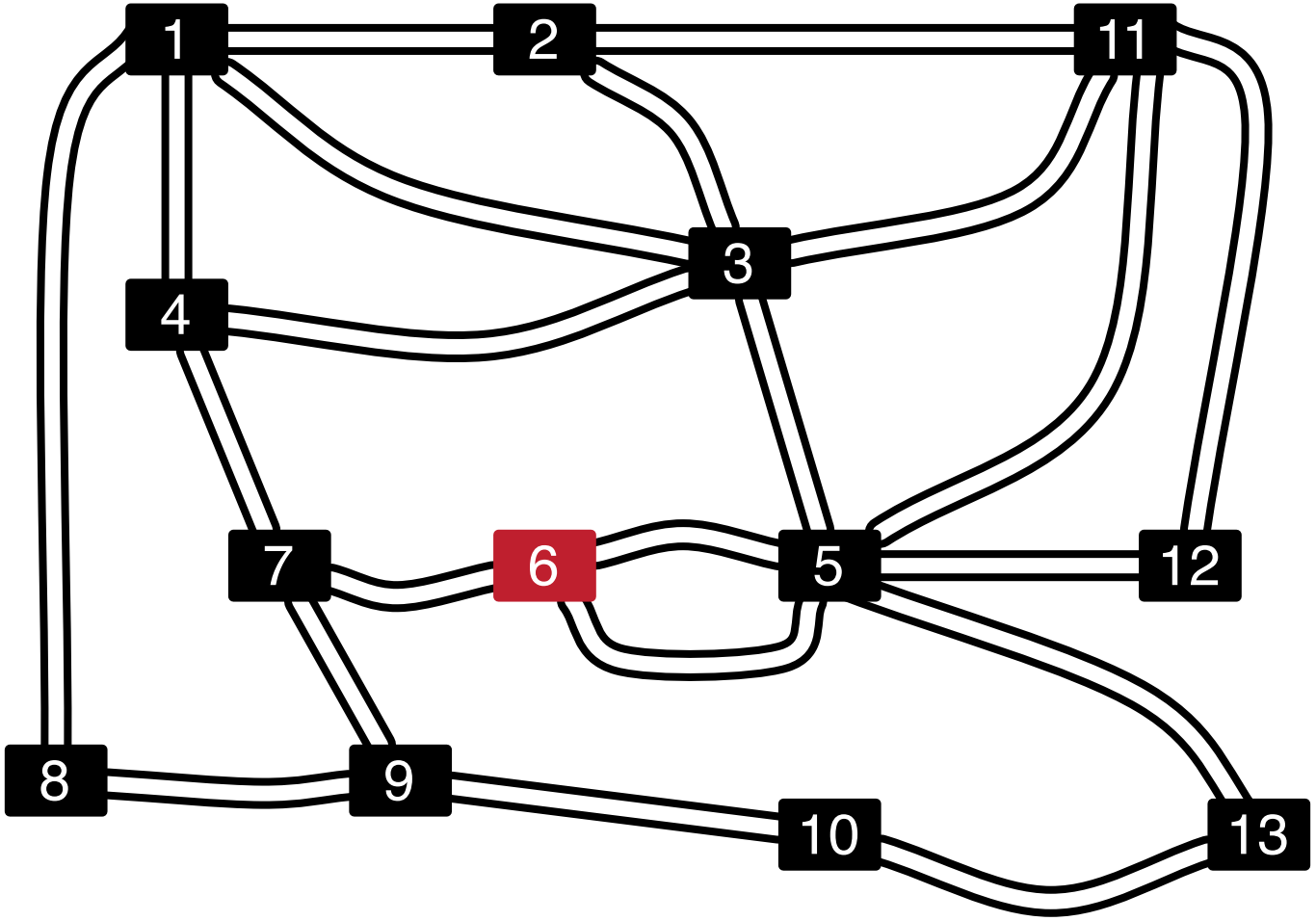
Example of Baseline



Schedule

(7,12,1) Arrived
(1,5,2) Arrived
(1,6,3) Arrived

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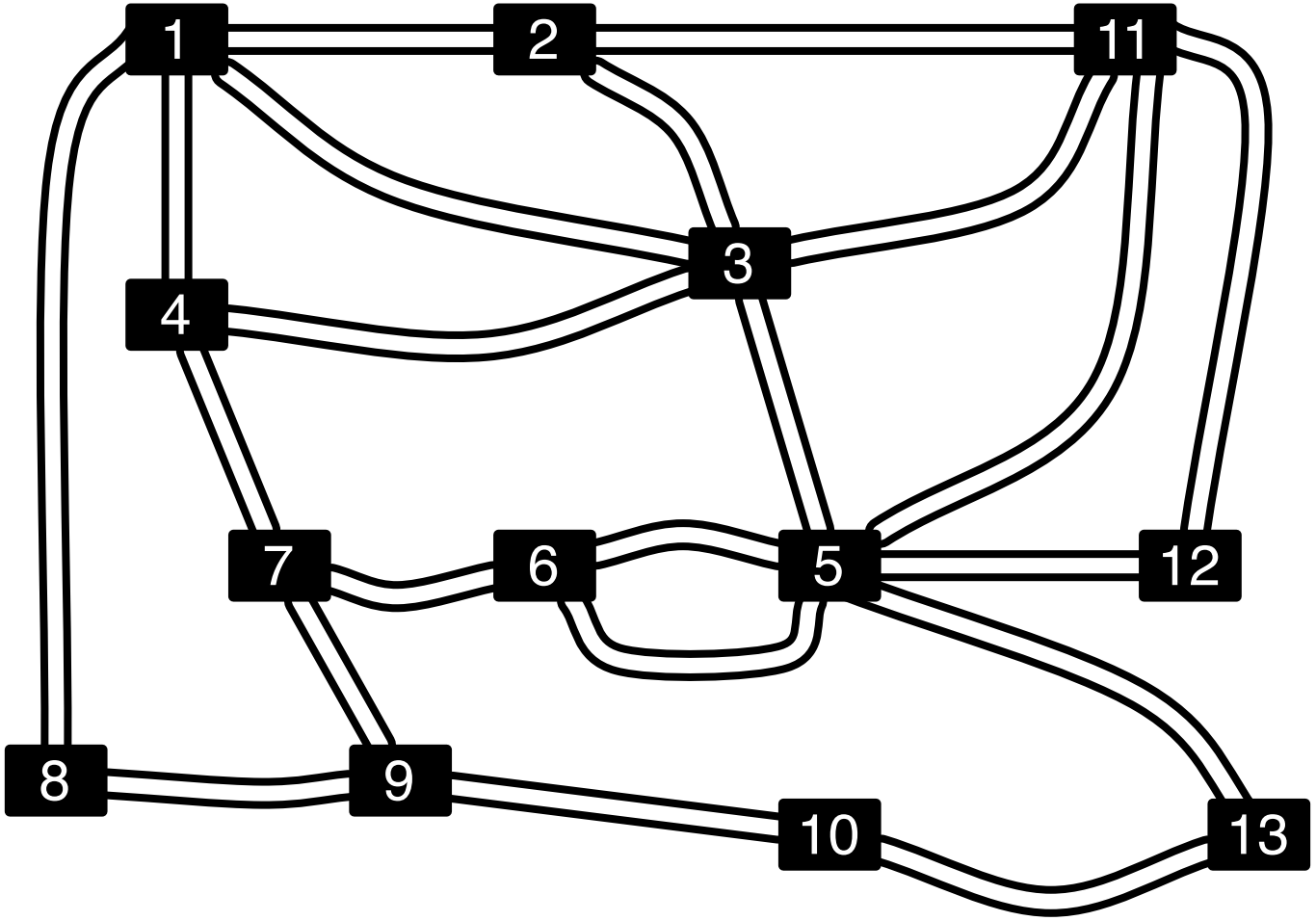
Example of Baseline



Schedule

(7,12,1) Arrived
(1,5,2) Arrived
(1,6,3) Arrived

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