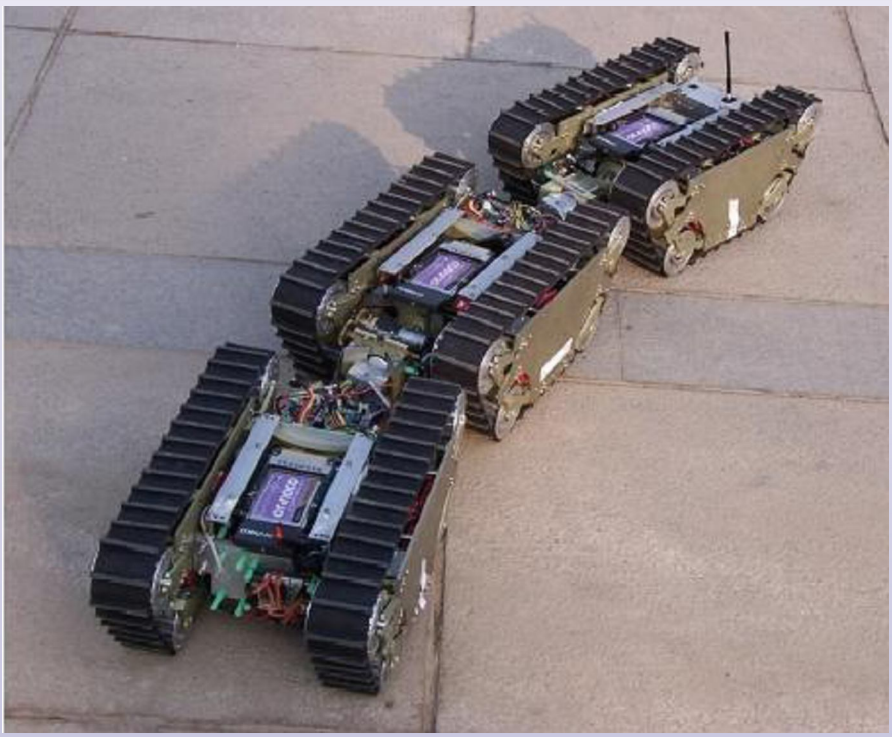
Shaastra 2009
THE SPIRIT OF ENGINEERING

Simulation Championship

Rescue Bot Mission

Introduction:

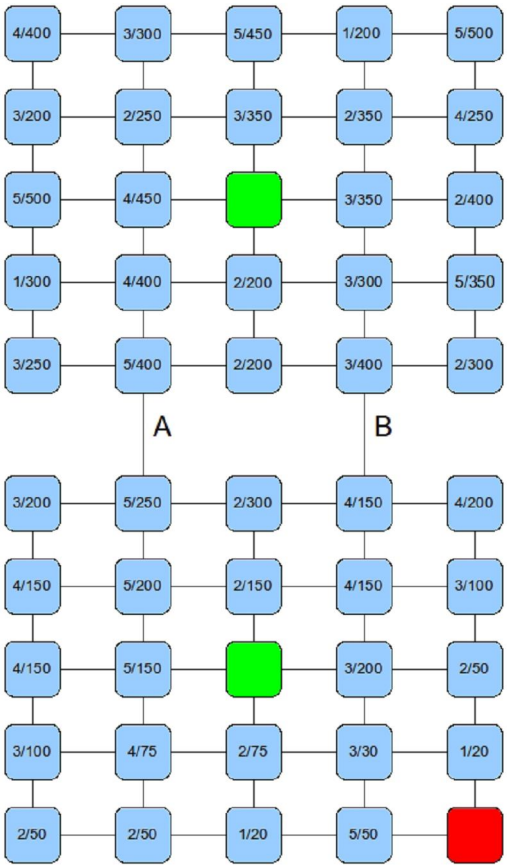
Remote controlled robots are used in dangerous, disaster scenarios for search and rescue operations. They can go to places too hazardous for humans rescue personnel. This problem is set in the future, where advanced robots have been created that are capable of rescuing people themselves. Use them wisely!



Problem Statement:

Objective:
The RC robot is remotely controlled and can be guided to perform a rescue operation. The objective is to save the maximum possible number of people, given the constraints.

Layout:



The figure shown is a graph depicting the layout of the building, which has caught fire. You have 6000 time units to save as many people as possible until the building crumbles. The nodes denote rooms, and edges are the passageways:

- Nodes are labelled with 2 numbers. The first is the number of people stuck in the room due to the fire. The second is the time each person in the room has got to survive- a number which could be estimated by the amount of smoke fumes filling the room.
- There are two kinds of special rooms. As enlisted below:
    - There is one node signifying an entry and exit point to the building(marked in red). The robot starts from here and can lead people to complete safety outside the building only through this point.
    - There are also safe rooms: (marked in green) These rooms contain first aid kits, and thus keeps the occupants safe, i.e., their timer is suspended. [However, on leaving the room, a person's life timer counts down from where it stopped on entering the safe room].
- The vertical edges take 10 units to travel and horizontal edges take 5 units.
- Edge B will collapse after 3000 units, after which it will no longer be usable.

Note about the layout:

- The given layout will help indicate the efficiency of your logic/algorithm in terms of number of people saved. However, you are advised make your own layouts/modify the specifics of this layout to test your simulation further. You may modify parameters like number of people in rooms, time parameters etc. You can come up with scenarios in which your logic works very well, and also in cases where it isn't efficient.

Robot guidelines:

- Each person in the map starts out with the time given in his respective node as a countdown timer, which represents the time he has left. On entering a safe room, this timer is temporarily suspended. On leaving the safe room, it counts down from where it had stopped.
- The robot is equipped with 2 oxygen masks. When it reaches the nodes, it can provide a maximum of 2 people with oxygen and thus escort them through the corridors(edges).
- Assume that the robot does not transfer people from one room to another room. It may transfer only from a room to a safe room or the exit.
- Amongst the people the robot is escorting, if one or more person's countdown timer reduces to zero on the way, the bot can choose other people to escort from the rooms. Ofcourse, the maximum number of people it can escort remains 2.

Questions

- Devise a suitable algorithm to guide the robot so as to save the maximum number of people, given the constraints.
- [Bonus] Run the simulation using two such robots. You can make both bots plainly use the same algorithm, or program them to cooperate.