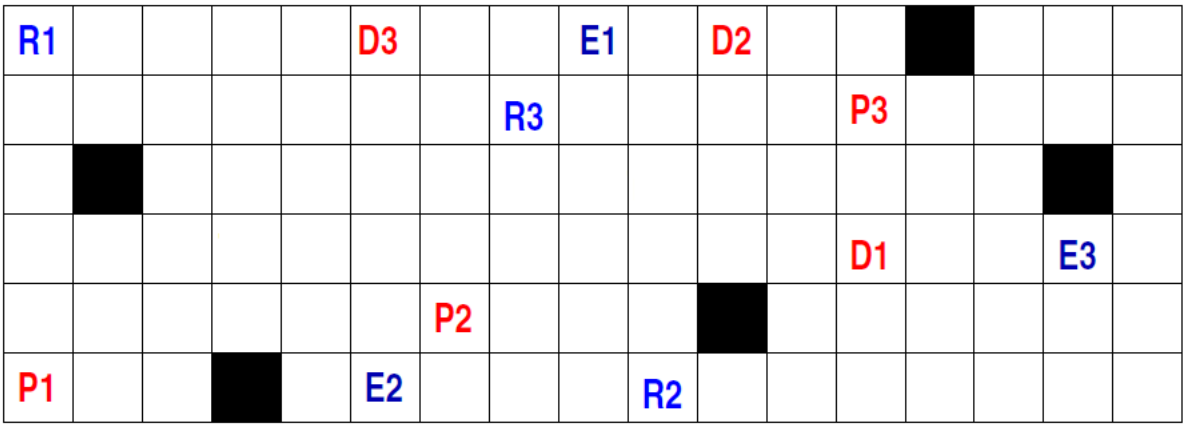
Multi Agent Path Finding

A certain shop floor is represented as a 2-D grid of size n x m, as shown in the figure below. In the shop floor, robots are employed to perform shipment tasks, where a task involves shipping a component from a designated pick-up cell location to a destination cell. There are 'k' robots and 'k' shipment tasks. Each robot performs a single task. A robot can move at most one cell (either vertically or horizontally) at a time step. A cell cannot be simultaneously occupied by more than one robot. Black coloured cells are obstacles and cannot be traversed through. All robots start at the same time. The i^{th} robot starts from cell location R_i, picks up one the components (say) at location P_j, delivers it in cell E_j and finally moves to cell D_i. The objective is to choose the appropriate task for each robot and determine its corresponding travel path, so that overall completion time for the work schedule involving all tasks is minimized.

Using the Google Colab environment, implement the 'Conflict Based Search (CBS)' algorithm [1] for finding an optimal solution to the above problem. Compare time overheads of the algorithm against a simple A* based implementation.



Make a google drive folder containing the following:

1. A report having the following sections: 1. Problem statement, 2. A step-wise depiction of the solution approach, 3. Screen shots of both input and output for various test cases including the one shown in the figure 4. Analysis and discussion
2. Runnable Google Colab Source code link with appropriate comments.

Submit the google drive folder link in teams.

[1] Sharon, Guni, et al. "Conflict-based search for optimal multi-agent pathfinding." *Artificial Intelligence* 219 (2015): 40-66.