Artificial Intelligence for Robotics

- Homework 9 -

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1. Answer the following questions:

   - What are Knowledge-Based agents?
   - What is Knowledge Base (KB)?
   - Which operations can Knowledge-Based agents perform?
   - What is logical reasoning?
   - What is syntax ?
   - What is a model?
   - What is entailment ?
   - What is inference ?
   - What is the difference between entailment and inference?

2. Assume a robot that needs to deliver packages to different cities by certain deadlines. The robot gets a list of packages and positions together with their associated deadlines. Based on its current position, the robot has to determine an order to deliver each package before the deadline ends.

   To simplify the problem, we make the following assumptions:

   - Start time is 0
   - The robot can move on straight lines to the different positions
   - Package drop off takes zero time
   - Robot can move 1 unit per cycle

   Your tasks are:

   - Implement an appropriate solver for the given constraint satisfaction problem (Depth-First-Search with backtracking). Implement the following three ordering strategies for the successor functions:

  - Line number on the list
  - Euclidean distance
  - Time to deadline
- Evaluate the performance of the algorithm and the different ordering strategies. For example, number of evaluations, path length for each of the given scenarios etc. An evaluation is performed any time the constraints associated with a partial path are checked for satisfaction.

On LEA, you will find different scenarios which need to be solved. The format of each scenario file is:

```
<robot initial X position> <robot initial Y position>
<delivery X position #1> <delivery Y position #1> <package deadline #1>
<delivery X position #2> <delivery Y position #2> <package deadline #2>
...
<delivery X position #n> <delivery Y position #n> <package deadline #n>
```

Notes

- Your are allowed to work in a team of two. **Team members must submit the same files. Each team member should be able to present the submitted solution.** Peer programming can be a useful resource.
- You can use any editor to complete this assignment. The following steps will show you how to use eclipse to compile and run your code:
  - Extract the files.
  - Open a terminal and go into the "air_assignment_09/build" directory.
  - Generate the MakeFile by running the command: cmake ..
  - Compile your code by running the command: make
  - Open eclipse.
  - Select File $->$ New $->$ MakeFile Project from Existing Code.
    - Project Name: Set this field to "air_assignment_09".
    - Exiting Code Location: Browse and select the "air_assignment_09" folder.
    - Toolchain for Indexer Settings: Select the option "Linux GCC".
    - Press finish.
  - Select your project in the Project Explorer and carry out the following actions:

    * Right click
    * Select properties
    * Select C/C++ Build
        · Change the build directory from ${workspace_loc:/air_assignment_09}/ to ${workspace_loc:/air_assignment_09}/build/
    * Select Run/Debug settings:
        · Select New
        · Select C/C++ Application
        · Press "OK"
        · Under the "Main" tab:
        1. Set "C/C++ Application:" to "bin/assignmet07".
        · Under the "Arguments" tab:
        1. Uncheck "Use default" under "Working Directory:".
        2. Change "Working Directory:" from ${workspace_loc:/air_assignment_09} to ${workspace_loc:/air_assignment_09}/bin/
- Run your program.