Artificial Intelligence (CS60045)

Assignment 2 (Theory)

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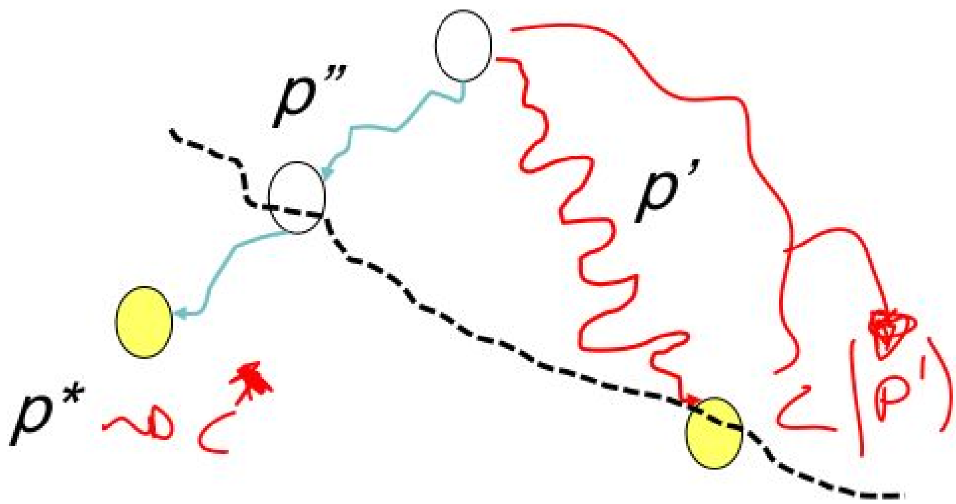
1.

Agent Type	Robot soccer player
Performance Measure	Wins games according to specified game rules, coordinates as a team, scores goals, defend own goal
Environment	Field, ball, own team, other team, own body
Actuators	Limbs (e.g. legs composed of servo motors and joints) for locomotion and kicking
Sensors	Camera, touch sensors, accelerometers, orientation sensors, wheel/joint encoders

2.
    a.
        i. **Given :** a set of cities C={c1, ...cn} and a distance function $d(c_i, c_j)$, which returns a positive integer for each pair of distinct cities.
        ii. **Solution space:** all possible paths formed by visiting each city exactly once.
        iii. **"Cost" of a path:** → sum of $d(c_i, c_j)$, for each unique pair c_i,c_j along the path.
        iv. **Goal:** find the path with minimum.
        v. **Thus**, a **search** problem, where the Solution space is searched to calculate and find the Solution path with minimum cost.
    b. If we relax the constraint for TSP such that each city can be visited more than one time (that is, there may be some cities visited more than one time) and the cost for repeated edges are not count, we can get a solution for MST problem.
    Thus, estimating the remaining cost for completing a partial tour with the sum of the link costs for the minimum spanning tree connecting the graph of cities not yet in the tour, gives a powerful, admissible heuristic.
3. (A)
    a. A* search takes into account both
        i. The of the path to a node c(p)
        ii. The heuristic value of that path h(p)
    b. Let f(p) = c(p) + h(p). estimate of the cost of a path from the start to a goal via p
    c. A* always chooses the path on the frontier with the lowest estimated distance from the start to a goal node constrained to go via that path.
    d. A* is complete and optimal if:

        i. the branching factor is finite
        ii. arc costs are > 0
        iii. h(n) is admissible

    e. It halts (does not get caught in cycles) because:
        i. Let f_{min} be the cost of the optimal solution path
        ii. Each sub-path p of s has cost f(p) ≤ f_{min} (Due to admissibility)
        iii. Let f_{min} > 0 be the minimal cost of any arc
            1. All paths with length > f_{min} / c_{min} have cost > f_{min}
        iv. A* expands path on the frontier with minimal f(n)
            1. Always a prefix of s on the frontier
            2. Only expands paths p with f(p) ≤ f_{min}
            3. Terminates when expanding s
        v. Let p* be the optimal solution path, with cost c*.
            1. Let p' be a suboptimal solution path. That is c(p') > c*.
            2. any sub-path p'' of p* on the frontier will be expanded before p' : A* won't be caught by p'



3. (B)