CS331: Answers to HW2

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1. a. States: Color[region], which is 0-4, 0 meaning not colored.

Initial State: Color[region] = 0 for all regions.

Actions: Assign(region X,color Y).

Successor function: Assign Color[X] := Y.

None of the other regions change colors.

Goal test: Color[x] > 0 for all x, and adjacent[x,y] => Color[x] <> Color[y].

Path cost: Could be the number of distinct colors used.

b. States: loc[monkey],loc[banana],loc[crate1],loc[crate2]

Initial State: initial value of the loc vector.

Actions: Move[object x,location y].

Successor function: Set loc[x] := y if reachable[x, y].

None of the other objects change.

Goal test: reachable(loc[monkey],loc[banana]).

We assume that reachable(X,Y) takes the value True if the locations are close enough.

Path cost: Number of actions in the plan

c. States: water[a],water[b],water[c].

Initial State: water[a]=water[b]=water[c]=0.

Actions: fill(x),empty(x),pour(x,y).

Successor function: fill(x): water[x] := capacity[x]

empty(x): water[x] := 0

pour(x,y): if water[x]+water[y] < capcity[y] then water[y] := water[x]+water[y];

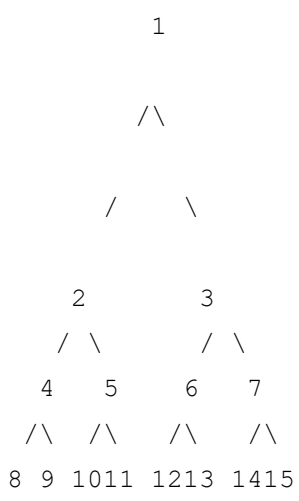
water[x] :=0;

else water[x] := water[x]+capacity[y]-water[y]; water[y] = capacity[y];

Goal test: water[a] = 1 or water[b] = 1 or water[c] = 1

Path cost: The number of actions.

2.(a)



(b) BFS: 1,2,3,4,5,6,7,8,9,10,11

DLS: 1,2,4,8,9,5,10,11

IDS: 1,1,2,3,1,2,4,5,3,6,7,1,2,4,8,9,5,10,11

(c) The branching factor is 1 in the backward direction and 2 in the forward direction. Bidirectional search would work well.

(d) Going backward from the goal is more efficient since there is actually no search at all.

(e) the following algorithm searches backwards from the goal and returns the path starting from the root.

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Solve (n)
   if (n = 1) then return {};
   else if n is even then return solve(n/2);Left
   else return solve(floor(n/2)); Right.
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3 a) There are n vehicles and n^2 possible locations, so we have $n^2 ! / (n^2 - n) !$ different states.

b) Each car has 5 possible actions, so the branching factor is 5^n.

c) A nontrivial heuristic is the city block distance:

$|n-i+1-x_i| + |n-y_i|$

d) (i) and (ii) are not admissible. (i) Because the cars move simultaneously, and (ii) because the presence of other cars might allow the car that is taking the maximum number of moves jump over the other cars and reduce the maximum. (iii) is admissible because while jumping can further reduce the number of moves made by the car with minimum h_i, it would also increase the number of moves for one other car. Since the other car already had at least as much h_i, the overall solution length cannot decrease below the min.