David Chen(0028625587)

Probelm 1. Search algorithms

(a) UNIV -> BRNG -> STEW -> HASS -> REC -> PMU -> LWSN -> WTHR -> HEAV -> ELLT

(b)
When depth bound = 0
HEAV
When depth bound = 1
HEAV -> PMU -> WTHR
When depth bound = 2
HEAV -> PMU ->STEW -> WTHR -> ELLT -> REC -> SC
When depth bound = 3
HEAV -> PMU -> STEW -> BRNG -> UNIV -> WTHR -> ELLT -> LWSN -> REC -> SC
When depth bound = 4
HEAV ->PMU -> STEW -> BRNG -> HASS

(c) LWSN(h=7) -> ELLT(h=3) -> WTHR(h=3) -> HEAV(h=2) -> PMU(h=0)

(d) LWSN -> SC(f=6) -> WTHR(f=4) -> HEAV(f=3) -> PMU(f=3)

Problem 2. Search and Heuristics

(a) Situation DFS might be better than BFS:

If goal(solution) is very far away from the start(root).

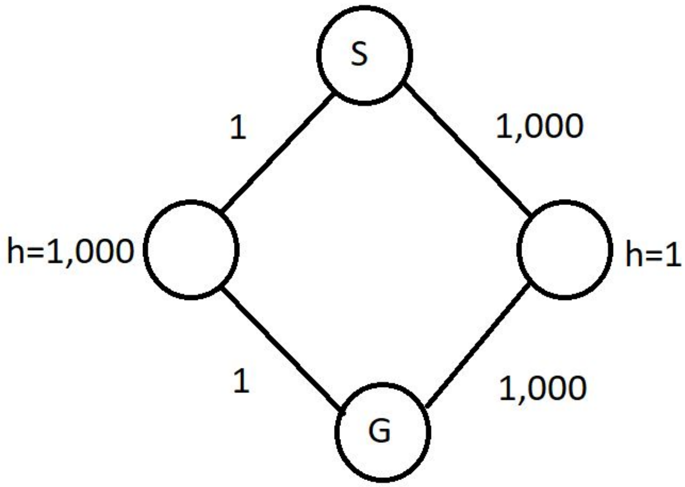
If goals(solutions) are frequent but located deep in the tree

If structure is very widely(too many neighbor) BFS is impractical.

For best example,

In the tree structure, if there is a lot of neighbor between each node and there are multiple goal node but they are located at the bottom of the tree. When you using DFS will reach the goal easily, if using BFS will taking a long time because BFS will search every single node before reach the goal.

(b)



S: start G: goal

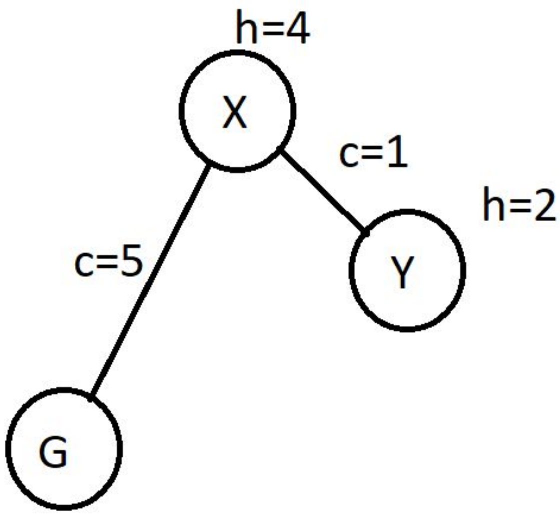
Non-optimal goal: S -> right node(h=1) -> G. Because right node(h=1) less than left node(h=1,000). Even the heuristic is smaller than left node but the real cost is larger than left node.
Optimal: S-> left node(h=1,000) -> G.

(c)

$h_1,\ h_2,\ h_3, ..., \ h_k$ be k consistent heuristics. $h^*(n)$ *is the maximum of the previous* h_k.
According to the admissible, the equation is $0 \le h(n) \le h^*(n)$. $h^*(n)$ is the maximum reveal every $h\,(n)$ will be smaller or equal to the $h^*(n)$. Therefore, $h^*(n)$ is admissible.

Admissible doesn't mean Consistent
$h^*(n) \le cost(n\ to\ n_k) + h(n_k)$. Then, $h^*(n)\ -\ h(n_k) \ge 0$. We don't know anything about the $cost(n\ to\ n_k)$. if $cost(n\ to\ n_k)$ is not large enough to hold the differences between $h^*(n)$ and $h(n_k)$, then the equation will not be held. Hence, admissible doesn't mean to be consistent.

(d)



Heuristic admissible:

$$h(x) = 4 \leq cost(x, g) = 5$$

Heuristic consistent:

$$5 = h(x) + cost(x, y) \geq h(y) = 2$$

$$3 = h(y) + cost(x, y) \geq h(x) = 4$$, which is not true

In this case shows the Heuristic of $h(x)$ is admissible but not consistent.

Problem 3. CSP

(a)

Variable = {A, B, C, D, E, F} is a set of variables.

Domain = {D8TO, 9GA, RUOK} is a set of respective domains of values.

Set D8TO as I, 9GA as J, RUOK as K

Constraint = $\{C_1, C_2, C_3\}$

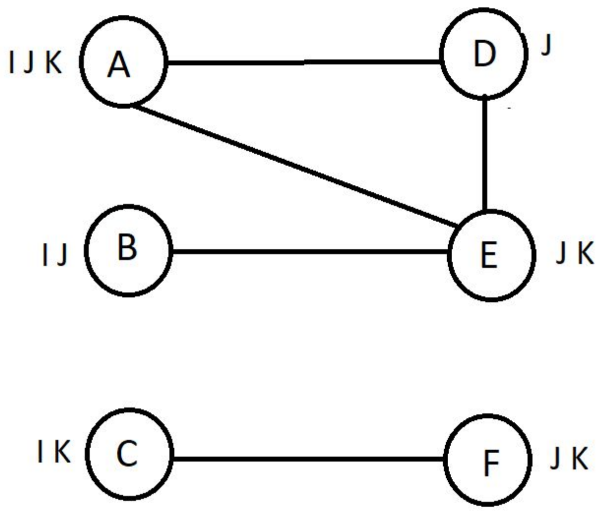
C_1 : A,D,E have to be performed in parallel

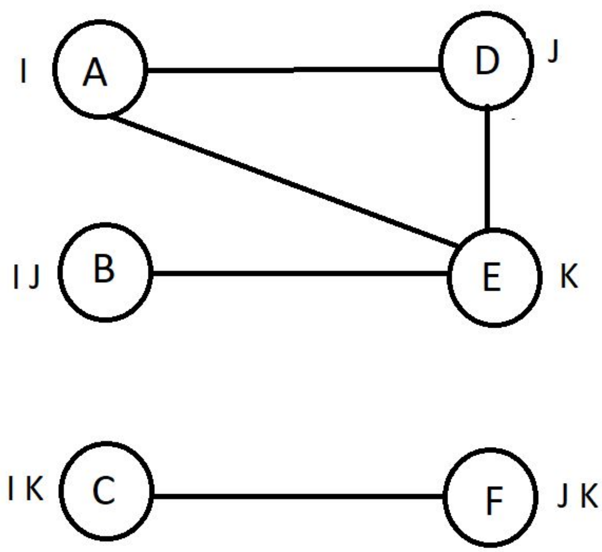
C_2 : B cannot also perform E

C_3 : F and C cannot be performed by the same unit

$A \neq D,\ A \neq E,\ D \neq E,\ B \neq E,\ F \neq C$

(b)





(c)

Structure of the graph:

We may using the relation graph to found out the best choice for each tasks.

First we have to assigned the robot 9GA to the task D. (because only 9GA can handle it)
After that we have to assigned the robot RUOK to the task E.(Task D and Task E constraint in 9GA)

And then we have to assigned the robot D8TO to the task A. (Same reason as above)

We don’t really care about which robot assigned to the task B because there is no constraint or conflict.

For the task C and task F: assigned robot D8TO to the task C or assigned robot 9GA to the task F will not cause counstrant.

Problem 4. ARC consistency

(a)

Just a concept not exactly same.

$Variable:$

$R_A,\ R_B,\ R_C$

$Domain:$

$C_1 = \{R_A,\ R_B\}$

$C_2 = \{R_B,\ R_C\}$

$C_3 = \{R_B,\ R_C\}$

$C_4 = \{R_A\}$

$C_5 = \{R_A,\ R_C\}$

$C_6 = \{R_A,\ R_B\}$

$C_7 = \{R_B,\ R_C\}$

$Constraint:$

$C_1 \neq C_6$

$C_1 \neq C_7$

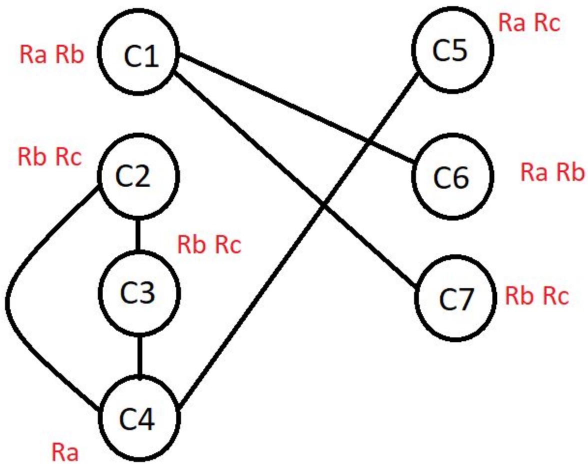
$C_2 \neq C_3$

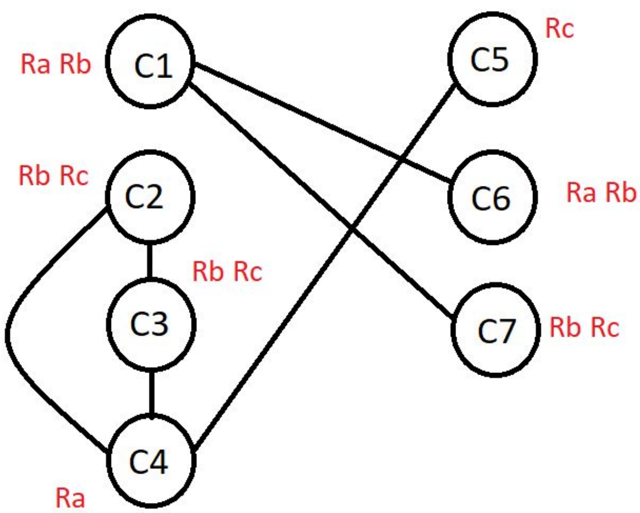
$C_2 \neq C_4$

$C_3 \neq C_4$

$C_4 \neq C_5$

(b)





(c)

Minimum Remaining Values :

C_4 , because it has minimum options.

Least Constrained Value :

C_4 , C_5 , because they rule out the fewest values in the remaining variables.