SOL. PARTIAL TEST 19/04/2018

EXERCISE 1

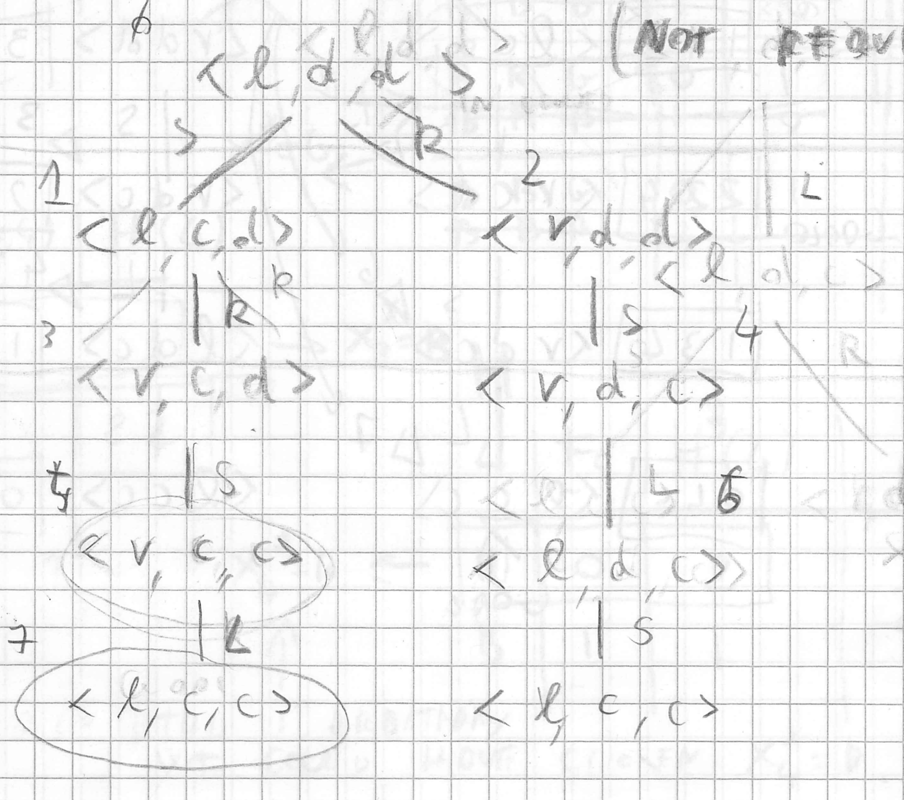
Q1) IDS is guaranteed to return the optimal solution in this setting, because the branching factor is finite and costs are uniform.

In particular in this case IDS will return Suck - Right - Suck - Left with cost 4 or Right - Suck - Left - Suck same cost.

Q2) BFS using graph search will return the optimal solution. Because branching factor is finite, costs are uniform and BFS expands node that requires a lower number of actions first. Hence even if we remove repeated states across different branches we are still guaranteed to find the least cost (optimal) solution.

Example BFS (not required)

0 <l, d, d>
1 <l, c, d>
2 <v, d, d>
3 <v, c, d>
4 <v, d, c>
5 <v, c, c>
6 <l, d, c>
7 <l, c, c> Goal



Q3) A^* IS OPTIMAL WITH GRAPH SEARCH ONLY IF HEURISTIC IS CONSISTENT

THIS HEURISTIC IS CONSISTENT

$H(n) \leq H(n') + C(n, n')$

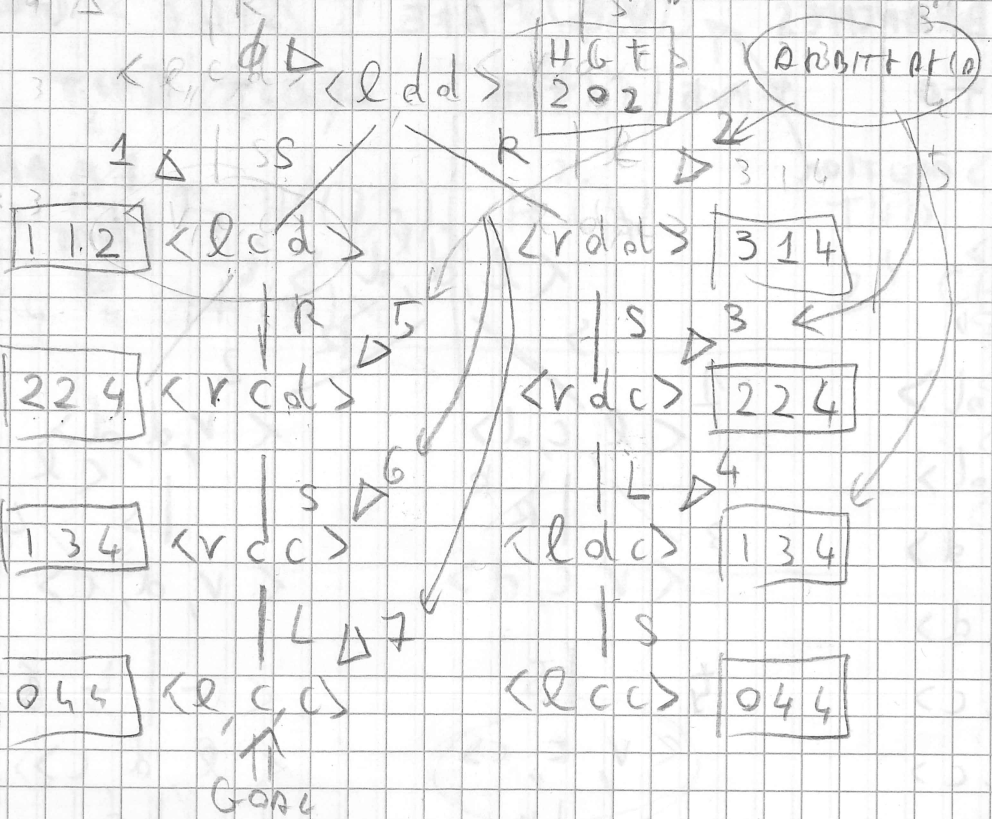
$H(n) - H(n') \leq 1$

#DIRTY SQUARES IN n + DISTANCE FROM n TO GOAL LOCATION − #DIRTY SQUARES IN n' + DISTANCE FROM n' TO GOAL LOCATION ≤ 1

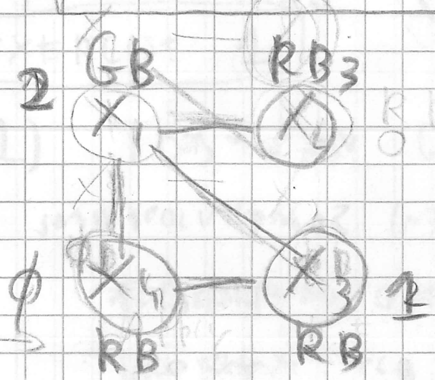
THIS IS TRUE BECAUSE THE AGENT CAN CLEAN AT MOST ONE SQUARE PER ACTION AND THE AGENT CAN ONLY MOVE ONE SQUARE PER ACTION. MOREOVER THE AGENT CAN EITHER PERFORM A MOVING ACTION OR A CLEANING ACTION BUT NOT BOTH. FINALLY THE COST FOR EACH ACTION IS 1 (1>0)

Q4) HENCE IT IS BEST TO PERFORM A^*

0 <l d d>
1 <l c d>
2 <r d d>
3 <r d c>
4 <l d c>
5 <r c d>
6 <r c c>
7 <l c c> GOAL



EXERCISE 2



$C^4 = R = \{R_{12}, R_{13}, R_{14}, R_{34}\}$

$C^3 = F = \{F_1, F_2, F_3, F_4\}$

Q1)

3	X_2	R_{12}	F_2	
2	X_1	R_{13} R_{14}	F_1	$H^2(1)$
1	X_3	R_{34}	F_3	$H^1(3,4)$
ϕ	X_4	F_4		$H^3(4)$

$H^2(1)$

$H^4(3,4)$

$H^3(4)$

M

X_1^*	X_2^*	X_3^*	X_4^*
G	B	B	R

OTHER POSSIBLE SOL → G B R B

$H^2(1)$

1	2	F_2	$H^2(1)$
G	R	0	1
G	B	1	
B	R	0	0
B	B	1	

$X_1^* = G$

$X_2^* = B$

$H^1(3,4)$

3	4	1	F_1	$H^2(1)$	$H^1(3,4)$
R	R	G	0	1	1
R	R	B	1	0	
R	B	G	0	1	1
~~R~~	~~B~~	~~B~~	~~1~~	~~0~~	
B	R	G	0	1	1
~~B~~	~~R~~	~~B~~	~~1~~	~~0~~	
B	B	G	0	1	1
~~B~~	~~B~~	~~B~~	~~1~~	~~0~~	

$X_3^* = B$
$X_4^* = R$

$X_1^* = G$

$H^3(4)$

4	3	F_3	$H^1(3,4)$	$H^3(4)$
B	R	0	1	1
R	B	1	1	2

$\to X_3^* = B$

$X_4^* = R$

M

4	F_4	$H^3(4)$	M
R	0	2	2
B	1	1	

$X_4^* = R$

THE MAXIMUM VALUE IS ARBITRARY WE COULD HAVE CHOSEN $X_4^* = B$. (SAME VALUE)

Q2) THE VALUE OBTAINED BY BEST CONFIGURATION IS 2

THIS IS NOT A UNIQUE VALUE BECAUSE B.E REPORTS THE SAME OPTIMAL VALUE FOR $X_4^* = R$ OR $X_4^* = B$ HENCE WE WILL HAVE AT LEAST TWO SOLUTIONS ACHIEVING THAT VALUE

Q3) YES, CHOOSE X_1 (MOST CONSTRAINED VARIABLE) AS LAST VARIABLE IN THE ORDER THAT WILL RESULT IN A BUCKET WITH 4 VARIABLES (1 2 3 4) HENCE REQUIRING A HIGHER COMP. EFFORT (2^4 CHECKS) TO COMPUTE TABLES (I.E. PROCESS BUCKETS)

EXAMPLE OF A POSSIBLE WORSE ORDER

X_1 R_{12} R_{13} R_{14} F_1	$H^1(2,3,4)$
X_2 F_2 $H^1(2,3,4)$	$H^2(3,4)$
X_3 R_{34} F_3 $H^2(3,4)$	$H^3(4)$
X_4 F_4 $H^3(4)$	

THIS REQUIRES 2^4 CHECKS

EXERCISE 3

Q1) X_1 — X_2 — X_3 X_4

(RB)   (RB)   (GB)   (RB)

THIS NETWORK IS A.C BECAUSE
FOR ANY VARIABLE AND ANY VALUE
WE CAN ALWAYS FIND A VALID ASSIGNMENT
FOR ANOTHER VARIABLE

IN OTHER WORDS, ANY REVISE OPERATION
ON ANY CONSTRAINT WILL NOT CHANGE
THE DOMAIN OF ANY VARIABLE.

Q2)

3 X_4 $A(X_4) = (X_2)$ ok

2 X_3 $A(X_3) = (X_1 X_2)$ ok

1 X_2 $A(X_2) = (X_1)$ ok

ϕ X_1 $A(X_1) = \phi$ ok

NET IS CHORDAL

MAX CLIQUES

$X_2\ X_4$

X_2

$X_1\ X_2\ X_3$

~~$X_1\ X_2$~~

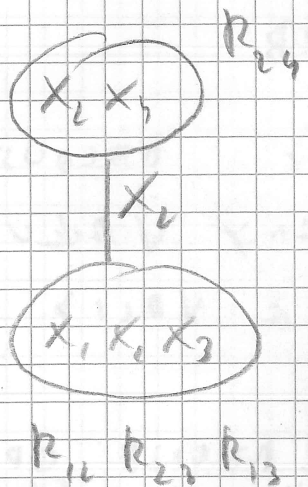
~~X_1~~

NET IS
NOT CONFORMAL

NO MATCHING
BETWEEN
$X_1 X_2 X_3$ AND
ANY CONS.

Q3) NEED TO USE JTC BECAUSE NET IS NOT ACYCLIC

USE SAME JOIN CHAIN BUT FORCE CONFORMALITY BY ALLOCATING CONSTRAINTS TO PROPER CLIQUES



R_{24}	2	4
	R	B
	B	R

R_{123}	1	2	3
	R	B	G
	B	R	G

X_1	X_2	X_3	X_4
B	R	G	B
R	B	G	R

OTHER SOL

$$REV\left(\left((24)(123)\right)\right) = \pi_{24}\left(R_{24} \bowtie R_{123}\right) = \left((R\ B)\ (B\ R)\right)$$