School of Data and Computer Science, Sun Yat-sen University

P03 Planning and Uncertainty

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November 6, 2019

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1 2×2 Rubik's Cube

Please solve the 2×2 Rubik's Cube by using FF planner. Here are 4 cases for you to verify the correctness of your programs (`pddl` files). You should hand in 5 files, including a domain file (`cube_domain.pddl`) and 4 data files (`cube1.pddl`,`cube2.pddl`,`cube3.pddl`,`cube4.pddl`). For more information about 2×2 Rubik's Cube, such as actions R, U and F, please refer to `https://rubiks-cube-solver.com/2x2/`.

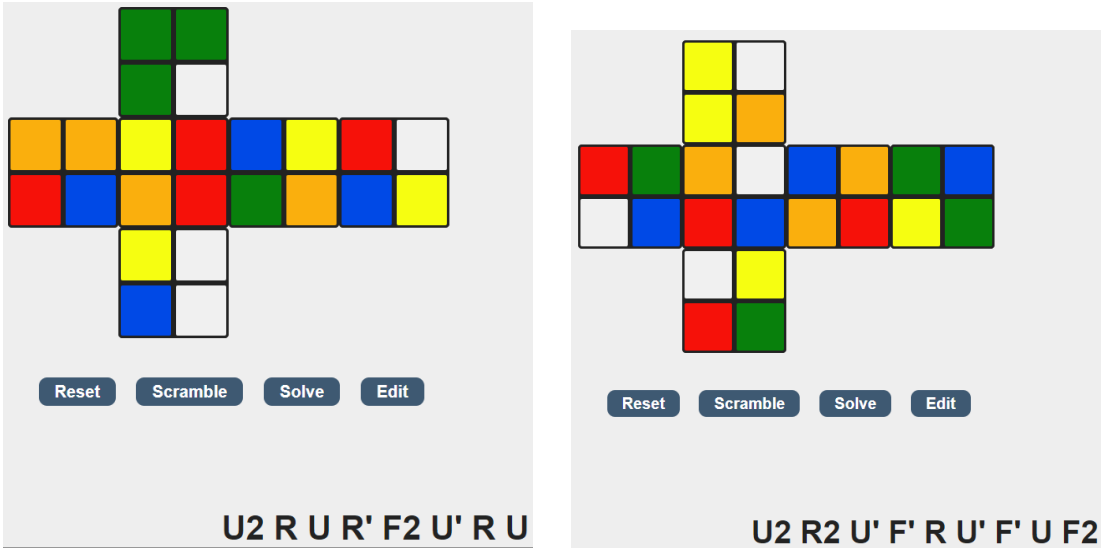

Figure 1: 2×2 Rubik's Cube case1 and case2

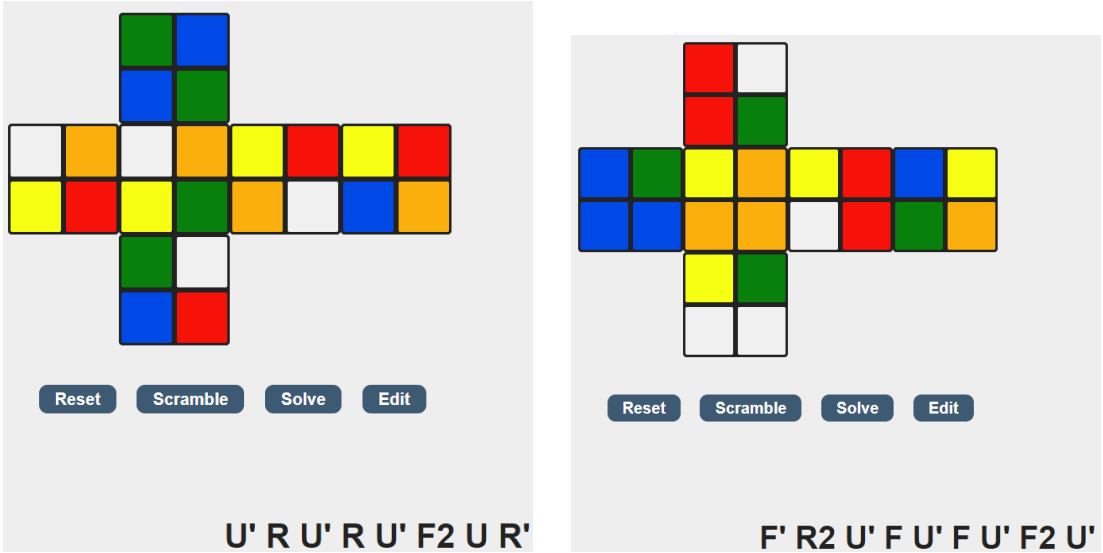

Figure 2: 2×2 Rubik's Cube case3 and case4

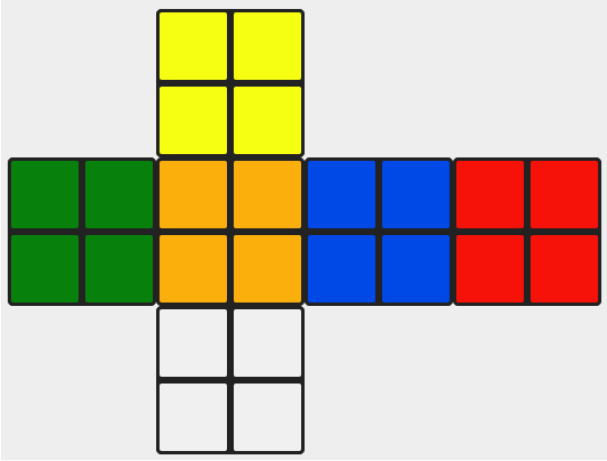

Figure 3: goal state

2 Diagnosing by Bayesian Networks

2.1 Variables and their domais

(1) PatientAge:['0-30','31-65','65+']

(2) CTScanResult:['Ischemic Stroke','Hemmorraghic Stroke']

(3) MRIScanResult: ['Ischemic Stroke','Hemmorraghic Stroke']

(4) StrokeType: ['Ischemic Stroke','Hemmorraghic Stroke', 'Stroke Mimic']

(5) Anticoagulants: ['Used','Not used']

(6) Mortality:['True', 'False']

(7) Disability: ['Negligible', 'Moderate', 'Severe']

2.2 CPTs

Note: [CTScanResult, MRIScanResult,StrokeType] means:

P(StrokeType='...' | CTScanResult='...' $\wedge$ MRIScanResult='...')

(1)

[PatientAge]

['0-30', 0.10],

['31-65', 0.30],

['65+', 0.60]

(2)

[CTScanResult]

['Ischemic Stroke',0.7],
['Hemmorraghic Stroke',0.3]

(3)
[MRIScanResult]

['Ischemic Stroke',0.7],
['Hemmorraghic Stroke',0.3]

(4)
[Anticoagulants]

[Used',0.5],
['Not used',0.5]

(5)
[CTScanResult, MRIScanResult,StrokeType])

['Ischemic Stroke','Ischemic Stroke','Ischemic Stroke',0.8],
['Ischemic Stroke','Hemmorraghic Stroke','Ischemic Stroke',0.5],
['Hemmorraghic Stroke','Ischemic Stroke','Ischemic Stroke',0.5],
['Hemmorraghic Stroke','Hemmorraghic Stroke','Ischemic Stroke',0],

['Ischemic Stroke','Ischemic Stroke','Hemmorraghic Stroke',0],
['Ischemic Stroke','Hemmorraghic Stroke','Hemmorraghic Stroke',0.4],
['Hemmorraghic Stroke','Ischemic Stroke','Hemmorraghic Stroke',0.4],
['Hemmorraghic Stroke','Hemmorraghic Stroke','Hemmorraghic Stroke',0.9],

['Ischemic Stroke','Ischemic Stroke','Stroke Mimic',0.2],
['Ischemic Stroke','Hemmorraghic Stroke','Stroke Mimic',0.1],
['Hemmorraghic Stroke','Ischemic Stroke','Stroke Mimic',0.1],
['Hemmorraghic Stroke','Hemmorraghic Stroke','Stroke Mimic',0.1],

(6)

```
[StrokeType, Anticoagulants, Mortality]

['Ischemic Stroke', 'Used', 'False',0.28],
['Hemmorraghic Stroke', 'Used', 'False',0.99],
['Stroke Mimic', 'Used', 'False',0.1],
['Ischemic Stroke','Not used', 'False',0.56],
['Hemmorraghic Stroke', 'Not used', 'False',0.58],
['Stroke Mimic', 'Not used', 'False',0.05],

['Ischemic Stroke',  'Used' ,'True',0.72],
['Hemmorraghic Stroke', 'Used', 'True',0.01],
['Stroke Mimic', 'Used', 'True',0.9],
['Ischemic Stroke',  'Not used' ,'True',0.44],
['Hemmorraghic Stroke', 'Not used', 'True',0.42 ],
['Stroke Mimic', 'Not used', 'True',0.95]
```

(7)

```
[StrokeType, PatientAge, Disability]

['Ischemic Stroke',   '0-30','Negligible', 0.80],
['Hemmorraghic Stroke', '0-30','Negligible', 0.70],
['Stroke Mimic',        '0-30', 'Negligible',0.9],
['Ischemic Stroke',     '31-65','Negligible', 0.60],
['Hemmorraghic Stroke', '31-65','Negligible', 0.50],
['Stroke Mimic',        '31-65', 'Negligible',0.4],
['Ischemic Stroke',     '65+'  , 'Negligible',0.30],
['Hemmorraghic Stroke', '65+'  , 'Negligible',0.20],
['Stroke Mimic',        '65+'  , 'Negligible',0.1],

['Ischemic Stroke',     '0-30' ,'Moderate',0.1],
['Hemmorraghic Stroke', '0-30' ,'Moderate',0.2],
```

```
['Stroke Mimic',          '0-30' ,'Moderate',0.05],
['Ischemic Stroke',       '31-65','Moderate',0.3],
['Hemmorraghic Stroke',   '31-65','Moderate',0.4],
['Stroke Mimic',          '31-65','Moderate',0.3],
['Ischemic Stroke',       '65+'  ,'Moderate',0.4],
['Hemmorraghic Stroke',   '65+'  ,'Moderate',0.2],
['Stroke Mimic',          '65+'  ,'Moderate',0.1],

['Ischemic Stroke',       '0-30' ,'Severe',0.1],
['Hemmorraghic Stroke',   '0-30' ,'Severe',0.1],
['Stroke Mimic',          '0-30' ,'Severe',0.05],
['Ischemic Stroke',       '31-65','Severe',0.1],
['Hemmorraghic Stroke',   '31-65','Severe',0.1],
['Stroke Mimic',          '31-65','Severe',0.3],
['Ischemic Stroke',       '65+'  ,'Severe',0.3],
['Hemmorraghic Stroke',   '65+'  ,'Severe',0.6],
['Stroke Mimic',          '65+'  ,'Severe',0.8]
```

2.3 Calculation

Please implement the VE algorithm (C++ or Python) to calculate the following probability value:

p1 = P(Mortality='True' $\wedge$ CTScanResult='Ischemic Stroke' | PatientAge='31-65')

p2 = P(Disability='Moderate' $\wedge$ CTScanResult='Hemmorraghic Stroke' | PatientAge='65+' $\wedge$ MRIScanResult='Hemmorraghic Stroke')

p3 = P(StrokeType='Hemmorraghic Stroke' | PatientAge='65+' $\wedge$ CTScanResult='Hemmorraghic Stroke' $\wedge$ MRIScanResult='Ischemic Stroke')

p4 = P(Anticoagulants='Used' | PatientAge='31-65')

p5 = P(Disability='Negligible')

3 Notes

1. For task1, I will grade your codes in correctness of 4cases, the number of steps, and time cost.
2. For task2, I will grade your codes in VE implementation, correctness of 5 cases and algorithm efficiency.

3. Please send **P03_YourNumber.zip** which should contain the codes and results of the above two problems to the mailbox (**ai_201901@foxmail.com**) before the deadline (**2019/11/27 23:59**).

4. Last but not least, you are not alone! If you find yourself stuck on something, contact the TA for help.