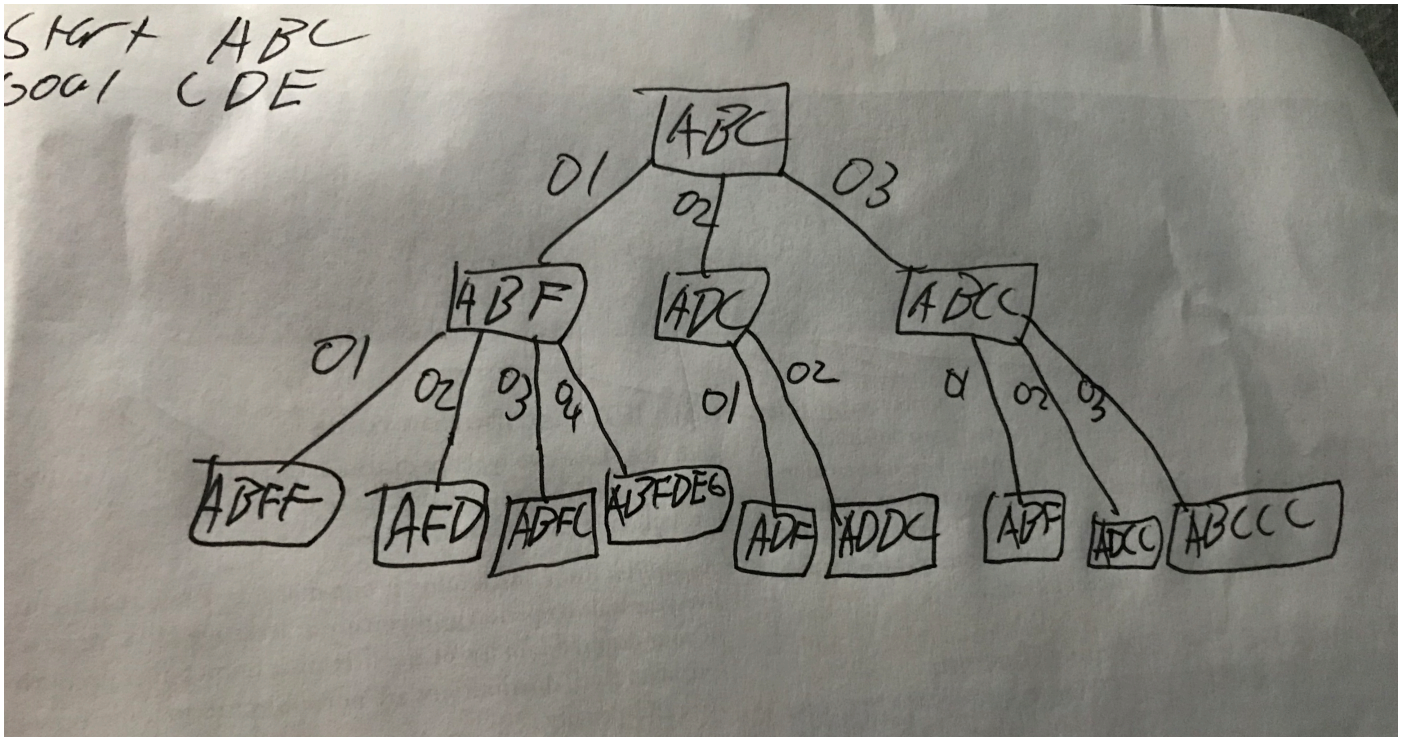
Homework 4 Written

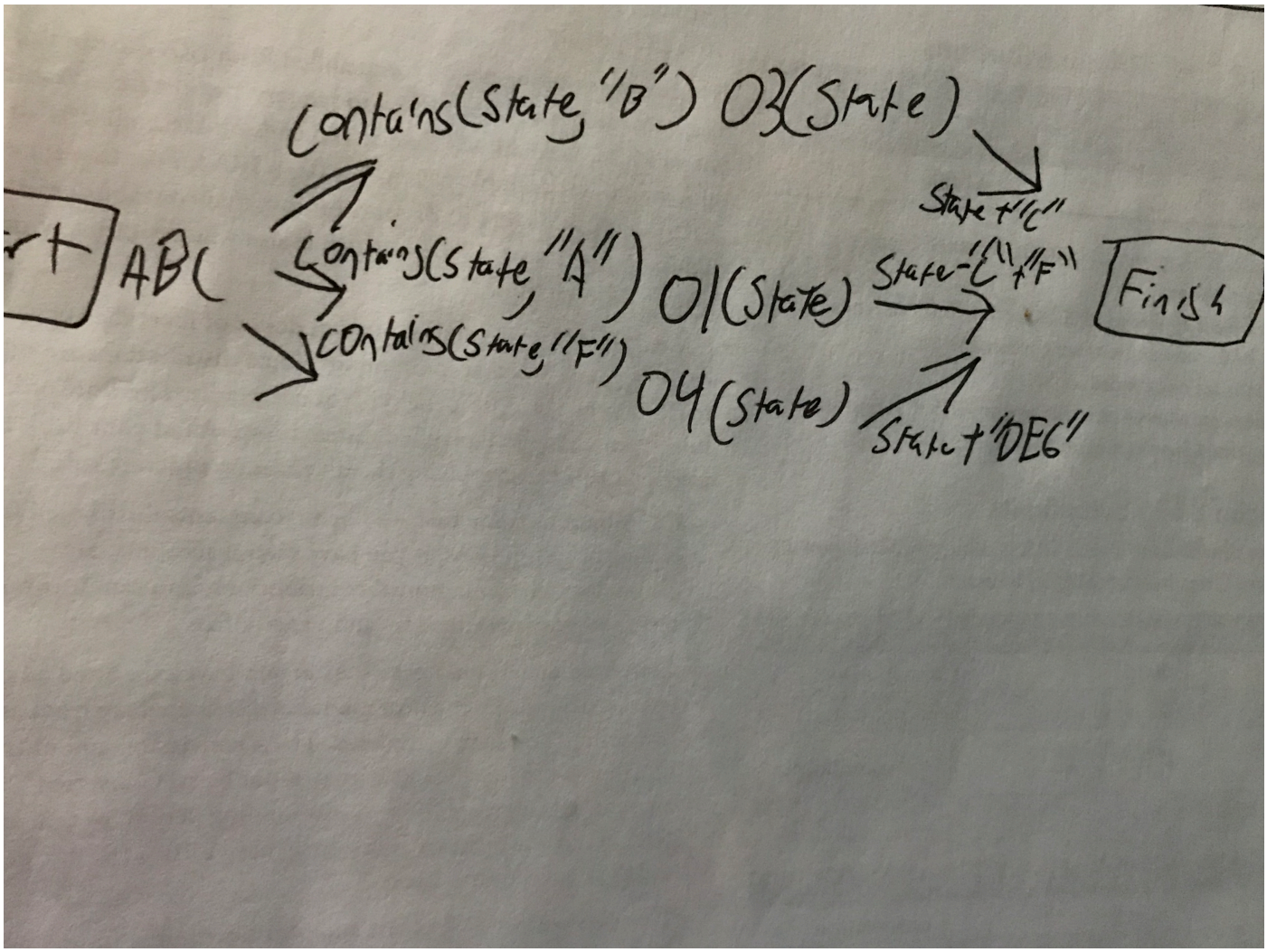
By Christopher Grant

1.

A. The search does not find a plan that achives the goal as there is no way to get a C, E and G that does not take at least 3 opperations



B.



2.

A. P(Toothache) = .108 + .016 + .012 + .064 = .2

B. P(cavity) = 0.108 + 0.012 + 0.072 + 0.008 = 0.2

C. P(Toothache|cavity) = (.108 + .012) / .2 = .6

D. P(Cavity|toothache∨catch) = 0.108 + 0.012 + 0.072 / P(toothache ∨catch)

P(toothache ∨catch) = 0.108+0.012+0.016+0.064+ 0.072 + 0.144 = 0.416

P(Cavity|toothache∨catch) = .192 / 0.416 = .462

3. D = “Having the disease”

P = “Testing Postive”

Want to Find: P(D|P)

P(D) = .02

P(~D) = .98

P(~P | D) = .06

P(P | D) = .94

P(P | ~D) = .09

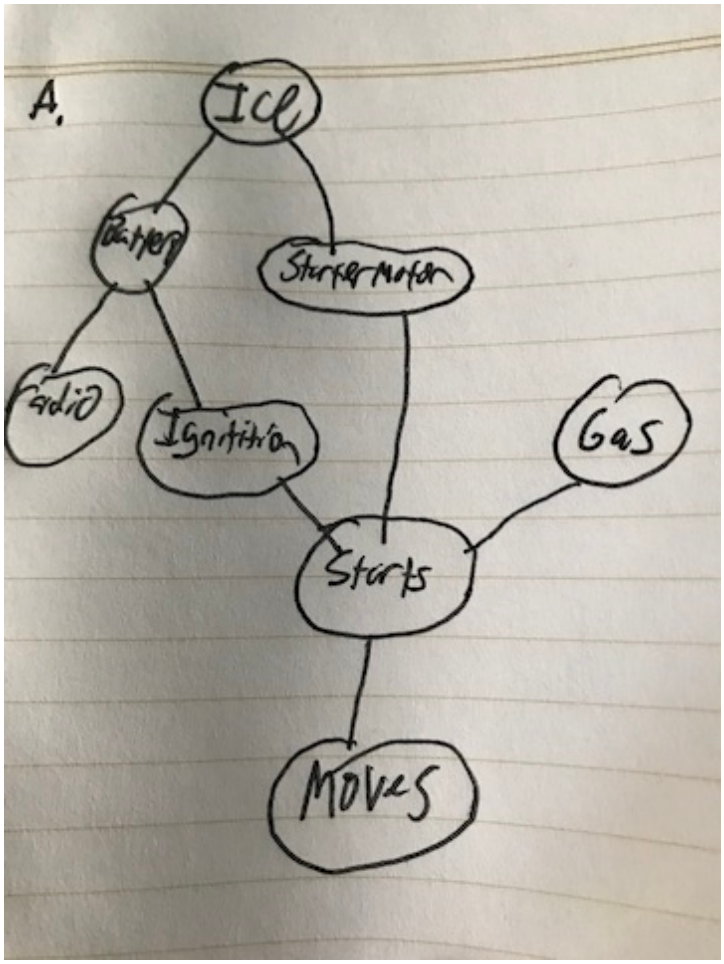
P(P) = P(P^D) + P(P ^ ~D)

P(P) = P(P|D)*P(D) + P(P|~D) * P(~D)

P(P) = .94 * .02 + .09 * .98
P(P) = .107

P(D|P) = P(P|D) * P(D) / P(P)
P(D|P) = .94 * .02/.107
P(D|P) = .176

4.
A.

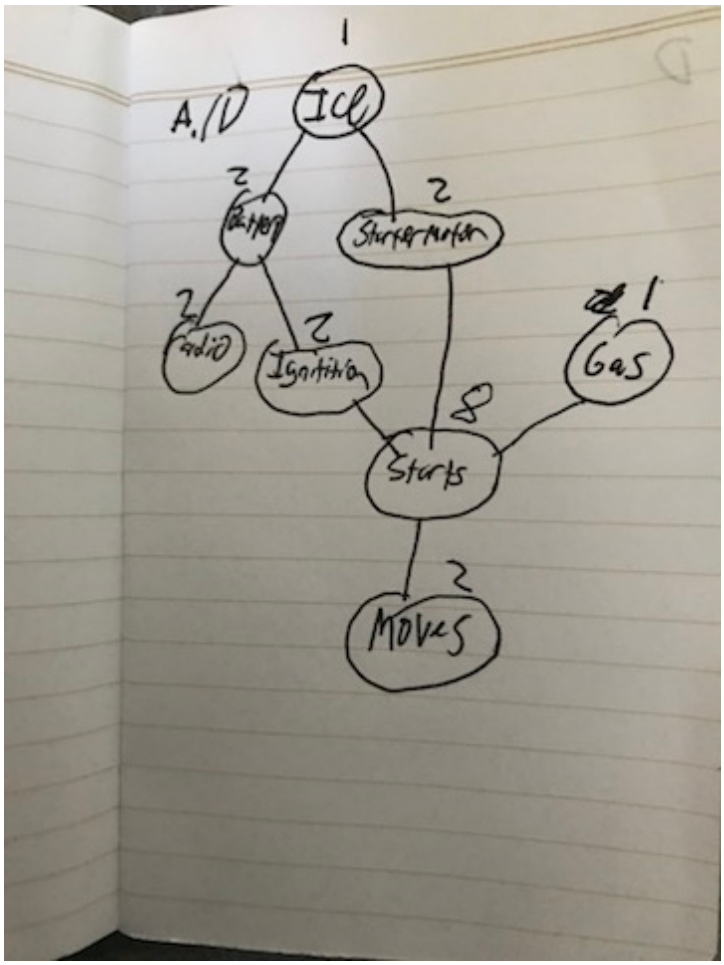


B.

P(Battery | IcyWeather) = .97
P(Battery | ~ IcyWeather) = .999
P(StarterMotor|IcyWeather) = 0.98
P(Battery|~IcyWeather) = 0.999.
P (Radio|Battery) = 0.9999
P (Radio|~Battery) = 0.05.
P (Ignition|Battery) = 0.998
P (Ignition|~Battery) = 0.01
P (Gas) = 0.997.
P(Starts|Ignition,StarterMotor,Gas) = 0.999
P(Moves|Starts) = 0.998.

C. Assuming no conditional independence, there are 2^8 -1 = 255 different entries

D.



Based on the chart above, there are 1+2+2+2+2+1+8+2 = 20 values

Full Joint Probability:

P(Battery = T) * P(Radio = T | Battery = T) * P(Ignition = T | Battery = T) * P(Gas=F) * P(Starts=T|Gas=F,Ignition=T) * P(Moves = F|Starts = T)

Computing Probability From Conditionals:

Assume that G = gas, R = radio, Moves = M, etc

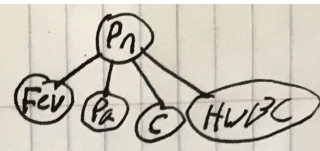
P (M = F) = $\sum_{b=T/F}\sum_{r=T/F}\sum_{i=T/F}\sum_{s=T/F}\sum_{g=T/F} P(B=b)*P(R=r|B=b)*P(I=i|B=b)*P(G=g)*P(S=s|G=g,I=i)*P(M=F|S=s)$

5.

$P(P_n \mid F, -P_a, C, -HWBC)$

$=$

$$\frac{P(P_n, F, -P_a, C, -HWBC)}{P(F, -P_a, C, -HWBC)}$$



$P(P_n) \cdot P(F \mid P_n) \cdot P(-P_a \mid P_n) \cdot P(C \mid P_n) \cdot P(-HWBC \mid P_n)$

$P(P_n) = .02$

$P(F \mid P_n) = .9$

$P(-P_a \mid P_n) = 1 - .7 = .3$

$P(C \mid P_n) = .9$

$P(-HWBC \mid P_n) = 1 - .8 = .2$

$= .02 \cdot .9 \cdot .3 \cdot .9 \cdot .2$

$= .000972$

$P(P_n) = .02$
$P(-P_n) = .98$
$P(F \mid P_n) = .9$
$P(F \mid -P_n) = .6$
$P(-P_a \mid P_n) = 1 - .7 = .3$
$P(-P_a \mid -P_n) = 1 - .5 = .5$
$P(C \mid P_n) = .9$
$P(C \mid -P_n) = .1$
$P(-HWBC \mid P_n) = 1 - .8 = .2$
$P(-HWBC \mid -P_n) = 1 - .5 = .5$

$P(F, -P_a, C, -HWBC) =$

$\text{Sum } P_n = T/F \; P(P_n) \cdot P(F \mid P_n) \cdot P(-P_a \mid P_n) \cdot P(C \mid P_n) \cdot P(-HWBC \mid P_n)$

$= P(P_n = T) \cdot P(F \mid P_n = T) \cdot P(-P_a \mid P_n = T) \cdot P(C \mid P_n = T) \cdot P(-HWBC \mid P_n = T) +$
$P(P_n = F) \cdot P(F \mid P_n = F) \cdot P(-P_a \mid P_n = F) \cdot P(C \mid P_n = F) \cdot P(-HWBC \mid P_n = F)$

$= (.02 \cdot .9 \cdot .3 \cdot .9 \cdot .2) + (.98 \cdot .6 \cdot .5 \cdot .1 \cdot .5)$

$= .000972 + .0147$

$= .015672$

$$\frac{P(P_n, F, -P_a, C, -HWBC)}{P(F, -P_a, C, -HWBC)} = \frac{.000972}{.015672} = .062 = 6.2\% \text{ Chance of PNEUMONIA}$$