AI Methods assignment 1 -Henrik Grüner

Task 1,1

The probabilities that a person will eat 0, 1, 2, 3, 4, or 5 or more bananas during a certain 30-minute period are 0.03, 0.18, 0.24, 0.28, 0.10, and 0.17, respectively. Find the probability that in this 30-minute period

a) more than 2 bananas are eaten?

P (X >2) = 0.28 + 0.1 + 0.7 = 55%

b) at most 4 bananas are eaten?

P (X ≤ 4) = 0.03 + 0.18 + 0.24 + 0.28 + 0.1 = 83%

c) 4 or more bananas are eaten?

P (X ≥ 4) = 0.1 + 0.17 = 27%

Task 1,2:

Defining some probabilities

P(HA) = Probability of two randomly picked apples is healthy:

P(HA|OneRotten) = probability of two randomly picked apples are healthy when the batch contains one rotten apples:

19/20 * 18/19 = 9/10

P(HA|TwoRotten) = probability of two randomly picked apples are healthy when the batch contains two rotten apples:

18/20*17/19 = 153/190

P(HA) = + P(OneRotten)*P(HA|OneRotten) + P(TwoRotten)*P(HA|TwoRotten) + P(HA|NoRotten)*P(NoRotten)

P(HA) = 0.3*9/10 + 0.1*153/190 + 0.6*1

P(HA) =0.95 = 95%

Bayes Rule

a) P(NoRotten|HA) = P(HA|NoRotten)*P(Norotten)/P(HA) = 1*0.6/(0.95) = **63.2%**

b) P(OneRotten|HA) = P(HA|OneRotten)*P(OneRotten)/P(HA)= 9/10 * 0.3/(0.95) = **28.4%**

c) P(TwoRotten|HA) = P(HA|TwoRotten)*P(TwoRotten)/P(HA)= 153/190 * 0.1/(0.95) = **8.5%**

Task 1,3

A form of common cold is known to be found in men over 50 with probability 0.07. A blood test exists for the detection of the disease, but the test is not infallible. In fact, it is known that 10% of the time the test gives a false negative (i.e., the test incorrectly gives a negative result) and 5% of the time the test gives a false positive (i.e., incorrectly gives a positive result).

a) If a man over 50 is known to have taken the test and received a favorable (i.e., negative) result, what is the probability that he has the disease?

Bayes theorem

$$P\ (TestIsNegative) = \frac{P(Sick)*P(Sick)}{P(TestIsNegative)}$$

Which gives P(Sick|TestIsNegative) = $\frac{0.1*0.07}{0.1*0.07+0.9*0.93}$ = 0.0083 **= 0.83%**

Task 1.4 A box of 12 computer sets contains 3 defective sets. In how many ways can a person purchase 5 of these sets and receive at least 2 of the defective sets?

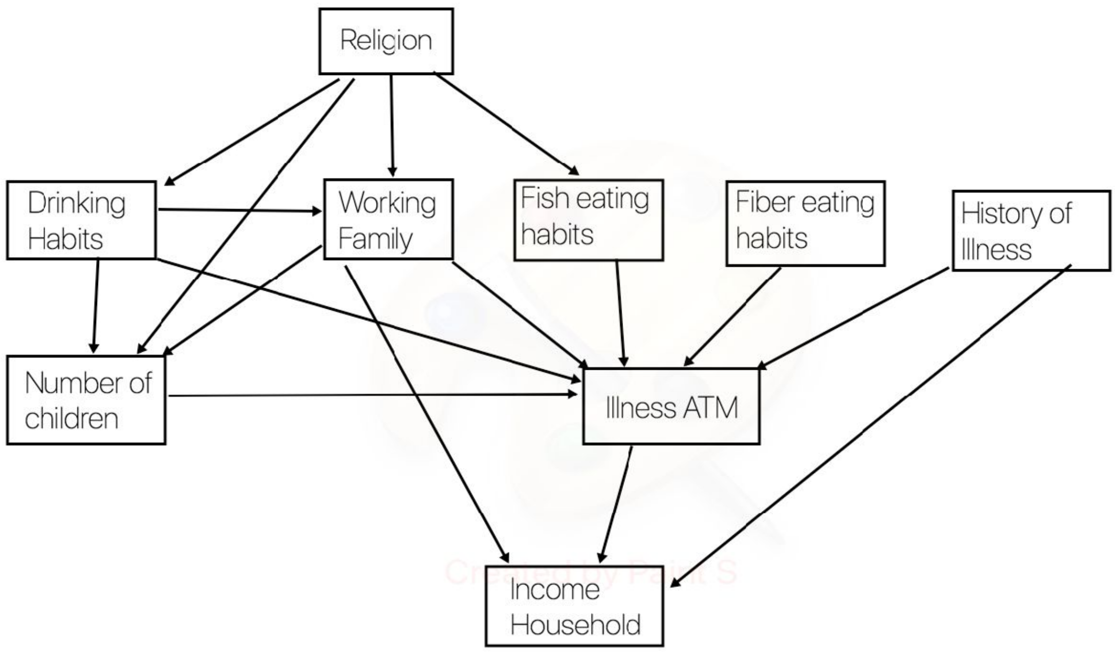
Can either purchase two defect or three defects.

i) Upon ordering three defect sets, there are 9 functioning computers left. Therefore, he can choose the last two computers in a total of combinations: $\binom{9}{2} = 36$

ii) Upon ordering two defect sets, there are three different ways of ordering the last three computers. The total of combinations: 3* $\binom{9}{3}$ = 252

Ergo, the total combination of ways to purchase 5 sets and receiving at least 2 of the defective sets are **36 + 252 = 288.**

Task 2



What are the conditional independence properties of the network you constructed? Are they reasonable?

World Assumptions:

Religion: Religion will affect your drinking habits (considered unethical), fish-eating habits (jews don't eat shellfish etc), working family (some strict religions), and also the number of children (prevention is considered unethical in some religions).

Drinking habits: Drinking habits will affect the number of children and if you're a working family (hard to maintain a job as an alcoholic). Also influences the illness atm, since alcohol is bad for you.
Working family: A working family affects illness atm (stress, etc), the family income, and number of children (hard to raise children while working).

Number of children: Number of children will affect illness atm (stress, etc).

Fish-eating habits: Will affect current illness (fish is healthy).

Fiber-eating habits: Will affect current illness (fiber is healthy).

History of illness: Will affect current illness and the income of the household.

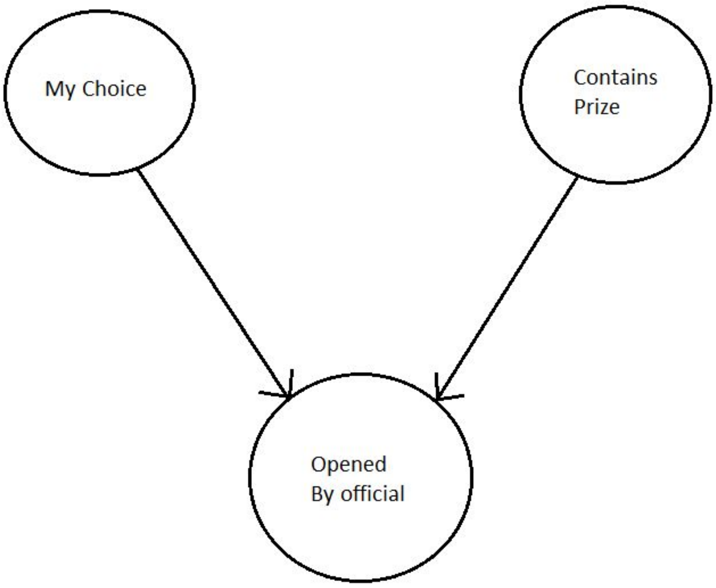
Conditional Indepences:

1. Given religion, it is reasonable that fish eating habits and drinking habits are independent
2. Income is conditional independent of fiber and fish eating habits given illness atm.

These are both reasonable.

Task 3
MC = My Choice
CP = Contains Prize
OBO = Opened By Official
di = door i

	P(MC)
d1	0.33
d2	0.33
d3	0.33



	P(CP)
d1	0.33
d2	0.33
d3	0.33

1. The values in bold represents P(OBO | MC, CP)

	Contains Prize	d1	d1	d1	d2	d2	d2	d3	d3	d3
	MyChoice	d1	d2	d3	d1	d2	d3	d1	d2	d3
Opened ->	door 1	**0**	**0**	**0**	**0**	**0.5**	**1**	**0**	**1**	**0.5**
by ->	door 2	**0.5**	**0**	**1**	**0**	**0**	**0**	**1**	**0**	**0.5**
Official ->	door 3	**0.5**	**1**	**0**	**1**	**0.5**	**0**	**0**	**0**	**0**

As seen in the table P(OBO | MC, CP), for each time his choice is unchanged, he would have gotten the prize two times by altering his choice. This means that altering his choice would give him a 67% chance of getting the price. This is due to the fact that the official opens a door without the prize. Staying with the original choice results in a 33% chance of getting the prize.

He should alter his choice.