Artificial Intelligence
Machine Problem 4 – Bayesian Network for Fraud Detection

**Introduction**
For this assignment you will build a simple Bayesian Network using Netica software that can be used to detect credit card fraud. A free version of Netica can be downloaded from the following web page:
https://www.norsys.com/netica.html

**Requirements**
We want to detect credit card fraud. We have found that the following factors can aid in detecting fraud:

- Whether or not there was a gas purchase in the last 24 hours
- Whether or not there was a jewelry purchase in the last 24 hours

Additionally we have found that the age and sex of the cardholder impacts the probability of a jewelry purchase. We are given the following probabilities based on historical data:

- 0.01% of all purchases are fraudulent
- The probability of purchasing gas in the last 24 hours is 1% when there is no fraud and 20% when fraud is involved.
- The probability of purchasing jewelry in the last 24 hours is 5% if there is credit card fraud. Otherwise it varies based on the age and sex of the cardholder (see table on next page).

| Age | Sex | Probability of purchasing jewelry in the last 24 hours |
|---|---|---|
| <30 | M | 0.0001 |
| 30-50 | M | 0.0004 |
| >50 | M | 0.0002 |
| <30 | F | 0.0005 |
| 30-50 | F | 0.002 |
| >50 | F | 0.001 |

**Make a pdf document that includes the following:**
**a)** Using Netica, make a Bayesian network that represents this situation and define the necessary CPTs. Include an image of the corresponding network file.

**b)** List the variable values maximize and minimize the probability of a fraud and list those probabilities.

**c)** Compute the following probabilities using your Bayes Net:

$$P(Fraud \mid gasPurchase, jewelryPurchase)$$
$$P(Fraud \mid gasPurchase, \neg jewelryPurchase)$$
$$P(Fraud \mid \neg gasPurchase, jewelryPurchase)$$
$$P(Fraud \mid \neg gasPurchase, \neg jewelryPurchase)$$

Note that you should get 4 vectors of two values (8 values total) as the answer.

**Additional Requirements**

1. The name of your source code file should be `mp4.pdf`
2. Your answers, including the Bayesian Network image need to be clearly legible and well organized.
3. Make sure the Bayesian Network itself is organized from causes (on top) to effects (on bottom).
4. At the top of the document, write the following information: your name, date, course name, semester, and assignment name.

**What to Turn In**
You will turn in the single mp4.pdf file using BlackBoard.

**Grading (15 points total)**
3 points for correctness of each subpart (a,b,c - 9 total). 6 points for satisfying all additional requirements.