Homework 4

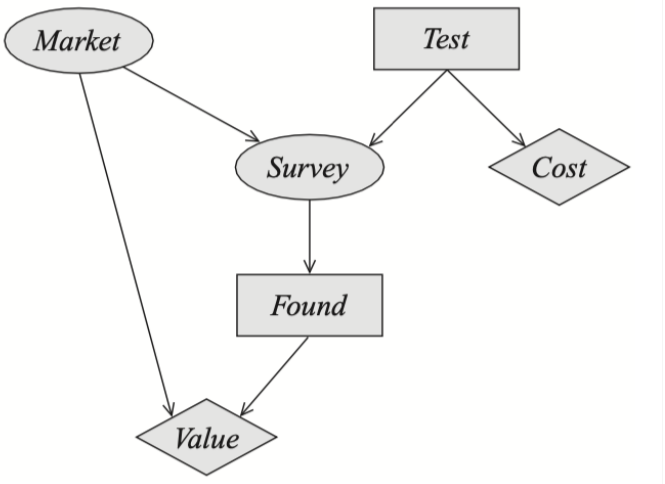
You, as an entrepreneur need to decide whether to found a company (F). Based on experience, you know that the market (M) can be in one of the three conditions m_0, m_1, m_2, with probability $0.5, 0.3, 0.2$ respectively. The profit (V) of the company depends on the market (M). Table 1 shows the profit from founding or not founding the company in a certain market.

Table 1 V(M, F)

Profit	M=m_0	M=m_1	M=m_2
Found (F=f_1)	-7	5	20
Not Found (F=f_0)	0	0	0

1). Calculate the expected profit of founding and not founding the company over the distribution of the market. Should you found the company?

Now a survey company offers you a survey of the market at cost C. In the quotation, the outcome of the survey (S) has a high probability to accurately reflect the market. Table 2 shows the probability distribution of the survey outcome in each market.



You need to decide whether you want to take the survey. If you take the survey and get a certain outcome, you also need to decide whether to found the company. To help with your decision, you draw the Bayesian decision network of the problem as Figure 1. Now answer the following questions with your knowledge of Bayesian decision network and value of information.

Table 2 P(S|M)

	$S=s_0$	$S=s_1$	$S=s_2$
$M=m_0$	0.6	0.3	0.1
$M=m_1$	0.3	0.4	0.3
$M=m_2$	0.1	0.4	0.5

(The settings of the problem are on Page 1089-1091 of the book *Probabilistic Graphical Models: Principles and Techniques* by Daphne Koller and Nir Friedman, The MIT Press (2009).)

2). Conditioning on each of the 3 outcomes of the survey, calculate: What is the posterior of the market P(M|S)? Should you found the company or not F| S? (Answer with 3 posteriors and 3 decisions)

3). What is the marginal probability distribution of the outcome of the survey P(S)?

4). What is the maximum amount that an entrepreneur should pay for the survey (based on value of information of the survey)?

Submission
Submit a pdf file named *network_YourLastName_YourFirstName.pdf* to Canvas. Write down detailed steps of answering each question, with formulas and calculation.
The due date and time for the submission is Tuesday, 11/08/2022 11:59PT.