IIMT2641, 2023-2024
Homework 1

Instructions:

You must submit your solutions via HKU Moodle by 10 am on Thursday, Sep 21. Any submission after this will be marked "late" in Moodle and will be given only partial credit.

What to submit to Moodle:
Your homework write-up — the work and associated answers to the questions below. This can be a Word file or a pdf. Alternatively, you may hand-write some of your solutions. If you do, you should scan your answers and upload the files as one pdf document. Any hand written solutions should be neat and easily legible. We cannot grade them if we cannot read them!

Write clearly about the process of solving the problem. For non-integer answers, round to the hundredth decimal place, e.g. 3.12, 10.91. If the homework involves work on Excel or R, please remember to submit the corresponding files digitally as well.

Questions:

1. Based on Covid-19 death statistics in the US as of August 2021, approximately: 45% are women (W), 55% are men (M), 71% are under age 85 (U85), 29% are 85 or over (O85), and 12.5% are men of age 85 years or over.
   (a) What percentage of all Covid-19 deaths are women who are 85 or older (O85)?
   (b) What percentage of all Covid-19 deaths are women under age 85?
   (c) What percentage of all Covid-19 deaths are men under age 85?
   (d) What percentage of all Covid-19 deaths are women or anyone 85 or older?

2. Based on Covid-19 death statistics in the US as of August 2021, approximately: 45% are women (W), 55% are men (M), 71% are under age 85 (U85), 29% are 85 or over (O85), and 12.5% are men of age 85 years or over.
   (a) If an O85 individual dies of Covid-19, what is the probability that this individual is a woman?
   (b) If a man dies of Covid-19. what is the probability that he was U85?
   (c) If a woman dies of Covid-19. what is the probability that she was O85?

3. Covid tests can confirm or rule out Covid-19 infection in people with or without Covid-19 symptoms. The most common testing method is PCR test. It typically has variable sensitivities and high specificities:
   - The base probability for people infected by Covid-19 is 0.20.
   - The probability that an infected person will test positive is 0.88.
   - The probability that an uninfected person will test positive is 0.05.

To better detect the infected person of Covid-19, can you give the probability that someone is actually infected if they test positive?

4. John is making a decision about whether to build a large plant, small plant or do nothing. The payoffs received for each size of plant will depend on the market, which could be favorable market or unfavorable market. The payoff matrix for this decision problem is presented in Table 1.

Table 1: Predicted Payoffs based on Market Demand and Development Size

	Market	
Size of Development	unfavorable	favorable
Do nothing	0	0
Small plant	-20	100
Large plant	-180	200

(Payoffs in thousand dollars)

John estimates a 40% chance that the market is favorable and a 60% chance that the market is unfavorable.

Before deciding on building a new plant, John has the option of hiring ABC, Inc. to conduct a market survey, at a cost of $10,000. Conditional on a positive survey result, the market will be favorable with probability 0.8 and unfavorable with probability 0.2. Conditional on a negative survey result, the market will be favorable with probability 0.3 and unfavorable with probability 0.7.

(a) Find the probabilities that ABC, Inc. will get a positive survey result. (Hint: There is always 40% chance that the market is favorable. This is an unconditional probability.)