

- 1. An international fashion house of men's wear has just completed the design of the spring/summer collection for year 2021. Before moving the new collection to mass production stage, the company is considering to appoint JJ, the famous Hollywood actor who starred in the latest star war movie, to be the ambassador of the new collection. The appointment of JJ has to be negotiated through an agent. If the negotiation is successful, i.e., JJ becomes the ambassador of the new collection, the company will pay \$1 million to JJ and \$100,000 to the agent. If the negotiation fails, the company will still have to pay the agent \$50,000 for his efforts.**

Without JJ as the ambassador, there is a 51% chance that the new collection will be a hit, and a 49% chance that it will be a bomb. In the case of a hit, the company will make a profit of \$20 million. In the case of a bomb, the company will suffer a loss of \$10 million. There is no gain or loss if the company does not mass produce the new collection.

If JJ becomes the ambassador of the new collection, there is a 75% chance that the new collection will be a hit. Based on the negotiating agent's estimation, there is a 55% chance that JJ will agree to become the ambassador.

In the event that a deal cannot be struck with JJ, the company's next plan is to decide whether to engage a handsome model to appear in all the advertisements of the new collection. The model will cost \$300,000. With the model appearing in the advertisements, there is a 60% chance that the new collection will be a hit.

- (a) Use a decision tree to represent the above problem.
- (b) Recommend a strategy for the company to adopt so that its expected final profit is maximized. What is the maximum expected final profit? What are the possible actual profits/losses of your recommended strategy?
- (c) What is the maximum amount of money (including agent fee) that the company can afford to engage JJ as the ambassador?

**2. Jack is a bachelor and he knows two nice ladies, Jane and Anne, for some time. He is seriously considering to advance his friendship with one of them to that of courtship, i.e., he is considering to pursue one of the ladies as his ‘girlfriend’ and eventually he would like to marry his girlfriend and start a family. Jack is not sure which lady is the better ‘girlfriend’ as each of them has her merits. Jack has three criteria for a perfect girlfriend -**

**(i) she is his Soul Mate (S);**

**(ii) she has good Earning Power and as a wife can strengthen the family’s finance (E);**

**(iii) she is well liked by Jack’s parents (P).**

Jack has set up the following pair-wise comparison matrices.

**Criterion**

	<b>S</b>	<b>E</b>	<b>P</b>
<b>S</b>	1	5	6
<b>E</b>	1/5	1	2
<b>P</b>	1/6	1/2	1

**Soul mate (S)**

	<b>Jane</b>	<b>Anne</b>
<b>Jane</b>	1	4
<b>Anne</b>	1/4	1

**Earning power (E)**

	Jane	Anne
Jane	1	1/6
Anne	6	1

**Liked by parents (P)**

	Jane	Anne
Jane	1	1/7
Anne	7	1

- (a) Draw a graphical representation of Jack's problem, stating clearly the overall goal, the criteria to be used, and the decision alternatives.

- (b) Compute the priority of each criterion (S, E, P) in terms of its contribution to the overall goal. State the most important criterion, the next important criterion and the least important criterion.**
- (c) Compute the consistency ratio (CR) and comment on its acceptability. For three criteria, the consistency index of a randomly generated pairwise comparison matrix is 0.58. (6 marks)**
- (d) Determine the overall priority for each lady and give your recommendation to Jack.**

- 3. A real estate company is about to launch its new condominium for sale. The weekly sales of the new condominium can be classified as “Low” and “High”. The company’s advertising strategy will be based on the weekly sales level. Since the company’s advertising budget cannot afford advertising all the time, the company is considering the following two advertising strategies:**
- (A) advertise when sales are low, do not advertise when sales are high;**
  - (B) advertise when sales are high, do not advertise when sales are low.**



Running advertisements in any week will have primary positive impact on sales in the following week. So, at the beginning of each week, the company will forecast as best as it could whether sales will be low or high that week. Based on the forecast, the company will decide whether to run advertisements that week. When advertising is done during a week, the probability of having low sales the following week is  $\frac{1}{5}$  or  $\frac{1}{10}$ , depending on whether the current week's sales are low or high. These probabilities are increased to  $\frac{1}{2}$  or  $\frac{1}{3}$ , depending on whether the current week's sales are low or high, when advertising is not done during the current week.

The cost of advertising for an entire week depends on the current week's sales - advertising costs \$200,000 if the current week's sales are low (more advertisements) while the cost is \$100,000 if the current week's sales are high (less advertisements). Before deducting advertising cost, the company's weekly profits are \$2,000,000 when sales are high but only \$500,000 when sales are low.

Let state 0 indicate the “Low” level of sales and state 1 indicate the “High” level of sales during a week, where each transition of the process goes from one week to the next.

- (a) For each of the two advertising strategies (A) and (B), construct the (one-step) transition probability matrix.

- (b) For each of the two advertising strategies (A) and (B), find the mean sojourn times for state 0 and state 1. Which strategy is better if the company wants to have short low sales period on the average? Which strategy is better if the company wants to have long high sales period on the average?
- (c) Calculate the steady-state probabilities for each of the two advertising strategies (A) and (B).
- (d) Find the long run expected weekly profit (including a deduction for advertising costs) for each of the two advertising strategies (A) and (B). Which strategy is better according to this measure of performance?