Continuous Assessment No 2

Numeric on Probability Distribution and Bayesian Network

1. **Independence of Random Variables**
   A and B are two random variables which can take values 0 or 1. Two joint probability distributions over A and B are provided in the tables below. For each case, argue whether A and B are independent.

Table 1: (a)

	A=0	A=1
B=0	0.12	0.18
B=1	0.28	0.42

Table 2: (b)

	A=0	A=1
B=0	0.20	0.18
B=1	0.28	0.34

2. Ram is trying to study the causes of aggressive behaviour in males. For his initial experiments, he decides to take into account two parameters, namely, the basal level of testosterone in the male (high or low) and the kind of neighbourhood he grew up in (violent/non-violent). Based on a survey of males in a city that he conducted, he estimated that 80% of the males grew up in non-violent neighbourhoods. He also gathered the following posteriors

	Testosterone	
Neighbourhood	High	Low
Violent	0.7	0.3
Non-Violent	0.4	0.6

		Aggression	
Testosterone	**Neighbourhood**	High	Low
High	Violent	0.75	0.25
High	Non-Violent	0.22	0.78
Low	Violent	0.60	0.40
Low	Non-violent	0.15	0.85

What is the probability that

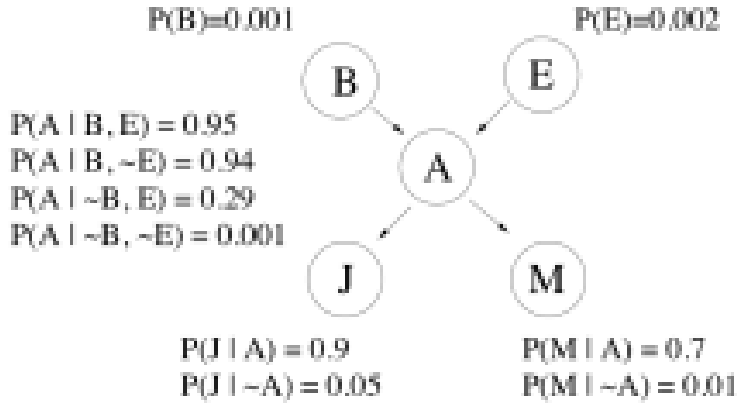
(a) A male who grew up in a non-violent neighbourhood is highly aggressive.

Solution:

(b) An arbitrarily chosen male who is highly aggressive, has high levels of testosterone and grew up in a non-violent neighbourhood.

Solution:

3) Consider the Bayesian Network shown in the figure involving A, B, C, D, E which are binary random variables. Note that P(B) = 0.001 means P(B = 1) = 0.001. Similarly P(A|B, ∼ E) = 0.94 means that P(A = 1|B = 1, E = 0) = 0.94. Compute P(A = 1, B = 1, E = 0, J = 1, M = 0)


P(B)=0.001
P(E)=0.002
B
E
A
J
M
P(A | B, E) = 0.95
P(A | B, ~E) = 0.94
P(A | ~B, E) = 0.29
P(A | ~B, ~E) = 0.001
P(J | A) = 0.9
P(J | ~A) = 0.05
P(M | A) = 0.7
P(M | ~A) = 0.01