

BRAC UNIVERSITY
CSE422 : Artificial Intelligence
Assignment 3

1. Consider the following probabilities involving the events A, B, and C:

- $P(A, B, C) = 0.2$
- $P(A, \neg B, C) = 0.15$
- $P(A, \neg B, \neg C) = 0.05$
- $P(\neg A, B, C) = 0.05$
- $P(\neg A, \neg B, C) = 0.05$
- $P(\neg A, \neg B, \neg C) = 0.35$
- $P(A) = 0.5$
- $P(\neg C) = 0.25$

Now solve the following problems:

- a. Create a joint probability distribution table for the events.
- b. Calculate $P(\neg B)$.
- c. Calculate $P(A | \neg B, C)$ and $P(\neg A | B, \neg C)$.
- d. Determine whether A, B, and C are independent or not.

2. Consider that 1 in 1000 people have a particular disease and a test for that disease has 1% false positive rate and 3% false negative rate.

- a. What is the probability of the patient having that disease given the patient tests positive once?
- b. What is the probability of the patient having that disease given the patient tests positive twice?

3. Consider the following datasets in the form $\{(x_i, y_i)\}^5$:

$$D_1 = \{(8, 1.2), (9, 1.3), (10, 1.5), (12, 1.8), (15, 2.3)\}$$

$$D_2 = \{(10, 1), (13, 1), (5, 0), (15, 1), (7, 0)\}$$

Let, the initial value of parameters $\Theta_i = i$, and learning rate $\eta = \frac{100}{100 * 10t}$, where t is the iteration number.

- a. Perform two gradient descent update steps of linear regression on D_1 .
- b. Perform two gradient descent update steps of logistic regression on D_2 .
- c. Derive the closed-form solution for the weight matrix in linear regression.