

**BRAC UNIVERSITY**  
**CSE422 : Artificial Intelligence**  
**Fall 2025**

**Duration: 30 minutes**

**Quiz 4**

**Total: 15 marks**

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**Name:** \_\_\_\_\_ **ID:** \_\_\_\_\_ **0.5 Points**

**Section:** \_\_\_\_\_ **0.5 Points**

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1. Consider the following dataset:

$x_1$	$x_2$	$y$
0	30.2	0
1	27.5	0
1	25.4	1
1	21.1	1

a. Calculate the model parameters of Gaussian Naive Bayes for the given dataset. (6 Points)

Solution:

$$p(y=0) = 0.5$$

$$p(y=1) = 0.5$$

$$p(x_1=0 | y=0) = 0.5$$

$$p(x_1=1 | y=0) = 0.5$$

$$p(x_1=0 | y=1) = 0$$

$$p(x_1=1 | y=1) = 1$$

$$\mu_0 = 28.85$$

$$\sigma_0^2 = 1.82$$

$$\mu_1 = 23.25$$

$$\sigma_1^2 = 4.62$$

b. Calculate  $p(y = 1 | x_1 = 1, x_2 = 26.1)$ . (4 Points)

Solution:

$$p(y = 1 | x_1 = 1, x_2 = 26.1) = \frac{p(x_1=1|y=1)*p(x_2=26.1|y=1)*p(y=1)}{p(x_1=1,x_2=26.1|y=0)*p(y=0)+p(x_1=1,x_2=26.1|y=1)*p(y=1)} = 0.805$$

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

$D = \{(5, 1.2), (7, 1.3), (8, 1.5)\}$

Let, the initial parameters  $\Theta_i = i$ , and learning rate  $\eta = 0.01$ .

a. Perform one gradient descent update step of linear regression on  $D$ . (4 Points)

Solution:

$$\theta := \theta + \eta \sum_{i=1}^n (y^{(i)} - h_{\theta}(x^{(i)})) x^{(i)}$$

$$\Theta_0 = -0.16$$

$$\Theta_1 = -0.11$$

### **Bonus**

Prove that the Naive Bayes classifier's estimate of the probability  $P(X | Y)$  is not always accurate. (1.5 Points)

Solution: