Course Code: COMP7180 Section Number: ASSIGNMENT Time Allowed: ____ Hour(s)
Course Title: Quantitative Methods for Data Analytics & Artificial Intelligence Total No. of Pages: ____

Question 1 (50 Marks)

Given two continuous random variables X and Y, if the joint distribution P(X,Y) has density function, which is shown as follows:

$$p_{XY}(x,y) = \begin{cases} c, & \text{if } x^2 + y^2 < 1 \\ 0, & \text{otherwise} \end{cases}$$

Answer the following questions.

1.1 What is the value c? Please provide details of your computation.

(10 Marks)

1.2.1 What is the density function with respect to (w.r.t.) the random variable X? Please provide details of your computation.

(10 Marks)

1.2.2 What is the Expectation w.r.t. the random variable X? Please provide details of your computation. (Hint: the integration of odd function is 0, that is $\int_{-a}^{+a} f(x)dx = 0$)

(10 Marks)

1.3.1 What is the Covariance of X and Y? Please provide details of your computation.

(10 Marks)

1.3.2 Whether X and Y are independent? Please provide details of your computation.

(10 Marks)

Question 2 (50 Marks)

Bayes' Theorem can be used to address many applications. Answer the following questions.

2.1 What is the Bayes' Theorem? Please describe it and prove it.

(10 Marks)

2.2 Bag -I contains 3 red and 8 green balls while another Bag -II contains 5 red and 2 green balls . One ball is drawn at random from one of the bags and it is found to be green. Find the probability that it was drawn from Bag -II. Please provide details of your computation.

(10 Marks)

A person uses his car 30% of the time, walks 20% of the time and rides the bus 50% of the time as he goes to work. He is late 7% of the time when he walks; he is late 3% of the time when he drives; and he is late 10% of the time he takes the bus.

2.3.1 What is the probability he took the bus if he was late? Please provide details of your computation.

(15 Marks)

2.3.2 What is the probability he walked if he is on time? Please provide details of your computation.

(15 Marks)

END OF PAPER