Assignment 3
AI1110 Probability and Random Variables

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Question 12.13.4.2: An urn contains 5 red and 2 black balls. Two balls are randomly drawn. Let X represent the number of black balls. What are the possible values of X? Is X a random variable ?

Solution:

The sample space of the experiment is S={RR,RB,BR,BB}.

X denotes the number of black balls.

X is a number whose values are defined on the outcomes of a random experiment.Therefore, X is a random variable.

For each outcome, its value is

$$X(RR) = 0 \tag{1}$$

$$X(RB) = 1 \tag{2}$$

$$X(BR) = 1 \tag{3}$$

$$X(BB) = 2 \tag{4}$$

The distribution of X is

$$\Pr(X = 0) = \frac{({}^2C_0)({}^5C_2)}{{}^7C_2} = \frac{10}{21} \tag{5}$$

$$\Pr(X = 1) = \frac{({}^2C_1)({}^5C_1)}{{}^7C_2} = \frac{10}{21} \tag{6}$$

$$\Pr(X = 2) = \frac{({}^2C_2)({}^5C_0)}{{}^7C_2} = \frac{1}{21} \tag{7}$$

$$\Pr(X = 0) + \Pr(X = 1) + \Pr(X = 2) = 1 \tag{8}$$

Therefore X={0,1,2}