***Discrete Random Variables***

Random variables can be classified as discrete or continuous, depending on the numerical values they assume.

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| A random variable that may  assume either a finite number of values or an infinite sequence of values such as 0,1,2,.... is referred to as a ***discrete random variable***. |

Examples of discrete random variables

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| Experiment | Random Variable x | Possible values  of R.V. |
| Contact 5 customers | no. of customers who place  an order | 0,1,2,3,4,5 |
| Inspect a shipment of 50 radios | No. of defective radios | 0,1,2,3,4,........49,50 |
| Operate a restaurant  for one day | number of customers | 0,1,2,3,4....... |
| Sell an automobile | Gender of the customer | 0 if male, 1 if female. |

We will look at two commonly used probability distributions for discrete random variables:

* The binomial distribution
* The Poisson distribution.

A random variable that may assume any numerical value in an interval or collection of intervals is called a continuous random variable.

**Discrete probability distributions**

The probability distribution for a random variable describes how probabilities are distributed over the values of the random variable.

For a discrete random variable x the probability distribution is defined by a probability function, denoted by f(x).

the probability function provides the probability for each value of the random variable.

Conditions for a discrete random variable

    1)  f(x) \;\geq \; 0

    2)  \sum  f(x) = 1

**Example**

The following data were collected by counting the number of operating rooms in use at the Mullingar General Hospital over a 20-day period.

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| Operating Rooms | No. of Days Used |
| 1 Room used | 3 |
| 2 Rooms used | 5 |
| 3 Rooms used | 8 |
| 4 Rooms used | 4 |

a) Use the relative frequency distribution approach to construct  a probability distribution for the number of operation rooms in use on any given day.  
  
  
**Solution**

Note that out of the 20 days. Only four outcomes were possible.On 3 days out of the 20, only one room was used

Let "***X***" be the number of rooms used on any given day.

Probability that the number of rooms used on a given day is one:

* ***f( X=1 ) = 3/20 = 0.15***
* ***f( x= 2 ) = 5/20 = 0.25***
* ***f( x= 3 ) = 8/20 = 0.40***
* ***f(x= 4 ) = 4/20 = 0.20***

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| **Value of Random Variable**  **(no. of rooms used)** | **Probability** |
| **1** | **0.15** |
| **2** | **0.25** |
| **3** | **0.40** |
| **4** | **0.20** |

b) Show that your probability distribution satisfies the required condition for a valid discrete probability distribution.

***First condition***

f(1) , f(2)  , f(3) and f(4) are all greater or equal to zero.

***Second Condition***

\sum  f(x) \\ = f(1) + f(2) +f(3) +f(4)\\ = 0.15 +0.25 +0.40 + 0.20\\
 = 1