



Probability Methods in Engineering

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Lecture 12



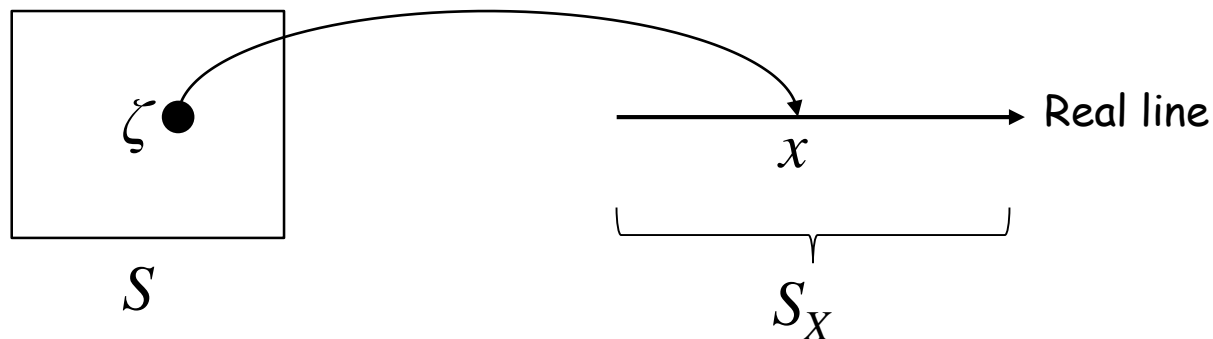
Random Variable

- Random Variable or RV
- "A function for assigning a number (numerical value) to each outcome of a random experiment"
- Outcome of random experiment not always a number
- Outcome has some measurement or numerical attribute
 - ❑ Interest in number related to outcome, called **value**
- Notations
 - ❑ Capital letters for RVs (X, Y, \dots)
 - ❑ Small letters for values (x, y, \dots)



Random Variable (cont.)

- RV X assigns number $X(\zeta) = x$, to each outcome ζ in the sample space of a random experiment





Examples

- A coin is tossed three times and the sequence of heads and tails is noted. The sample space for this experiment is $S = \{HHH, HHT, \dots, TTT\}$. Let X be the number of heads in the three tosses. X assigns each outcome ζ in S a number from the set S_X . Find S_X .



Examples (cont.)

- A coin is tossed three times and the sequence of heads and tails is noted. The sample space for this experiment is $S = \{HHH, HHT, \dots, TTT\}$. Let X be the number of heads in the three tosses. Let Y be the number of points obtained for each outcome such that 8 points are awarded for three heads, 1 point for two heads and no point otherwise. Find S_Y .



Examples (cont.)

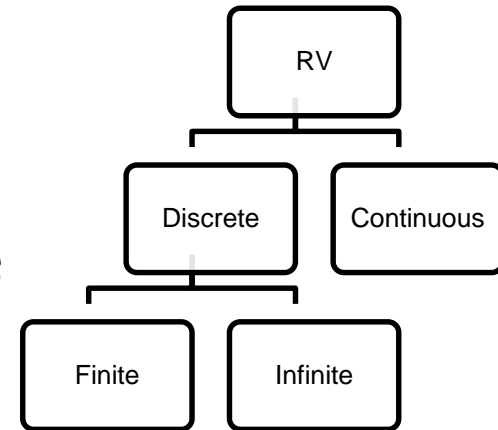
- Consider a hockey player, Y = the number of goals the player has scored during the season. Find S_Y .
- Survey a group of 10 hockey players; Z = the average number of goals scored by the players during the season. Find S_Z .
- Throw two dice, X = the sum of the numbers facing up. Find S_X .
- Throw one die over and over until you get a six, F = the number of throws. Find S_F .

Source: <http://www.zweigmedia.com/RealWorld/Summary6.html>



Discrete and Finite RVs

- Discrete RV has only specific, isolated numerical values
 - ❑ Finite discrete RV has finite possible values
 - E.g. outcome of roll of a dice
 - ❑ Infinite discrete RV has unlimited number of values
 - E.g. number of stars in universe
- Continuous RV can have any values within a continuous range or an interval
 - ❑ E.g. temperature in lab 1, height of a person in cm



Source: http://www.zweigmedia.com/ThirdEdSite/tutstats/frames8_1.html



Examples (cont.)

➤ Discrete or continuous?

- ❑ Flip a coin three times; X = the total number of heads
- ❑ Count the number of restaurants in a city; X = the number of restaurants in a city
- ❑ Measure the height of a table; X = its height in cm

Source: <http://www.zweigmedia.com/RealWorld/Summary6.html>



Examples (cont.)

➤ Discrete or continuous?

- ☐ Throw two dice over and over until you roll a double six; X = the number of throws
- ☐ Take a true-false test with 100 questions; X = the number of questions you answered correctly
- ☐ Invest Rs. 10,000 in stocks; X = the rounded value of your next investment after a year
- ☐ Select a group of 50 people at random; X = the exact average height (in m) of the group

Source: <http://www.zweigmedia.com/RealWorld/Summary6.html>