Probability Methods in Engineering
CSE-209

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Lecture 10

Bernoulli Trial

➢ Experiment with only two outcomes

➢ Either success or failure

❏ Flip a coin

❏ Take a penalty shot on goal

❏ Test a randomly selected circuit to see whether it is defective

❏ Roll a die and determine whether it is a 6 or not

❏ Determine whether there was flooding this year at Warsak

The Binomial Probability Law

➢ Sequence of independent Bernoulli trials
  ❑ k number of successes
  ❑ n number of independent Bernoulli trials
➢ k successes in n trials
➢ Probabilities of k given by binomial probability law

$$p_n(k) = \binom{n}{k} p^k (1-p)^{n-k}$$

➢ Graphical representation online tool
http://www.zweigmedia.com/RealWorld/stats/bernoulli.html

The Binomial Probability Law (cont.)

➢ Properties:

- ❑ 2^n possible outcomes of experiments with n Bernoulli trials
- ❑ Binomial probabilities sum to 1
- ❑ If $p_n(k)$ is given, $p_n(k+1)$ can be determined as

$$p_n(k+1) = \frac{(n-k)p}{(k+1)(1-p)} p_n(k)$$

Examples

➢ Suppose that a coin is tossed three times. If we assume that the tosses are independent and the probability of getting a heads is 0.4. Find the probabilities of 0, 1, 2 and 3 heads.
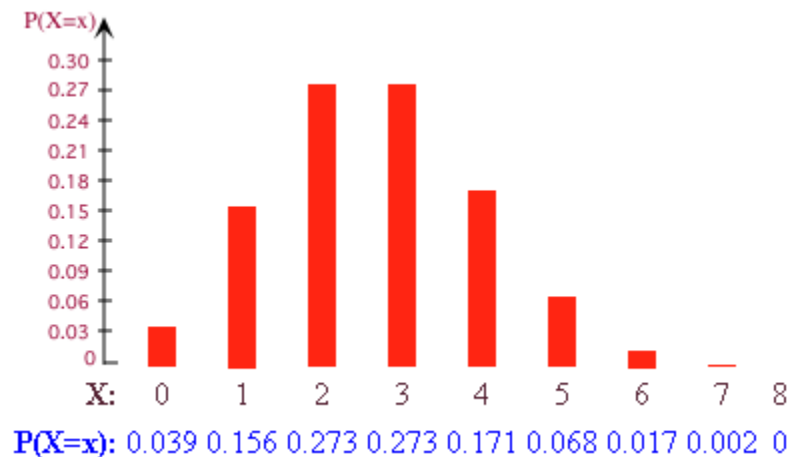
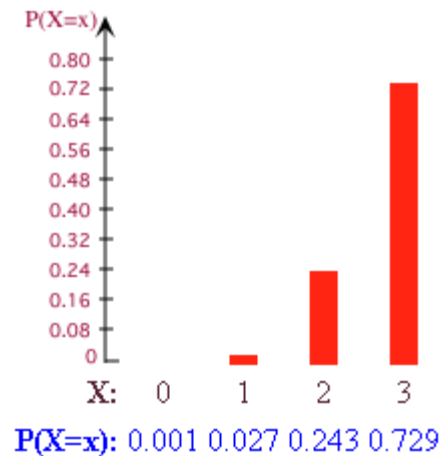➢ Verify the previous example using the binomial probability law

➢ Let k be the number of active speakers in a group of 8 speakers. Suppose that a speaker is active with probability 1/3. Find the probability that the number of active speakers is greater than 6.

| X:	0	1	2	3	4	5	6	7	8
P(X=x):	0.039	0.156	0.273	0.273	0.171	0.068	0.017	0.002	0

➢ A communication system transmits binary information over a channel that introduces random bit errors with probability $\varepsilon = 0.1$. The transmitter transmits each information bit three times, and a decoder takes a majority vote of the received bits to decide on what the transmitted bit was. Find the probability that the receiver will make an incorrect decision.

P(X=x): 0.001 0.027 0.243 0.729

➢ What is the probability of getting heads exactly twice if you flip a fair coin 6 times?
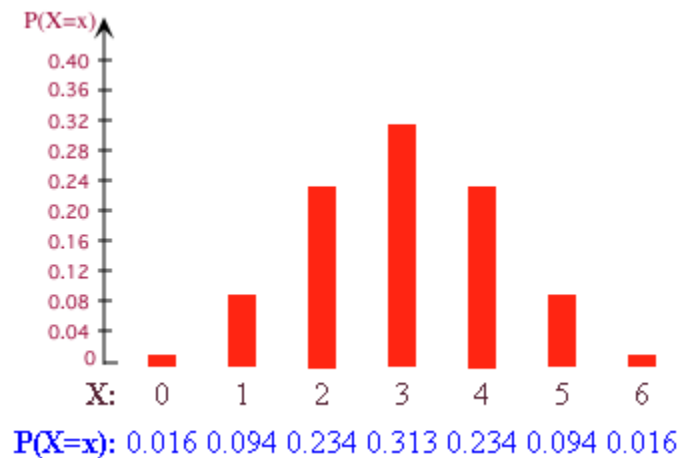
Examples (cont.)

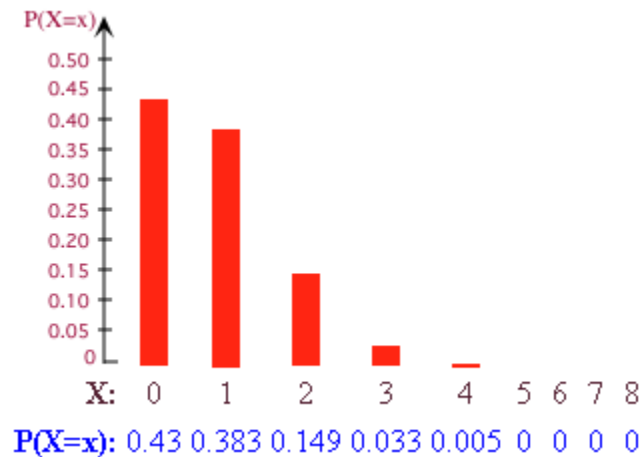➢ What is the probability of getting heads more than 4 times if you flip a coin 6 times having 0.6 as the probability of heads?

X:	0	1	2	3	4	5	6
P(X=x):	0.004	0.037	0.138	0.276	0.311	0.187	0.047
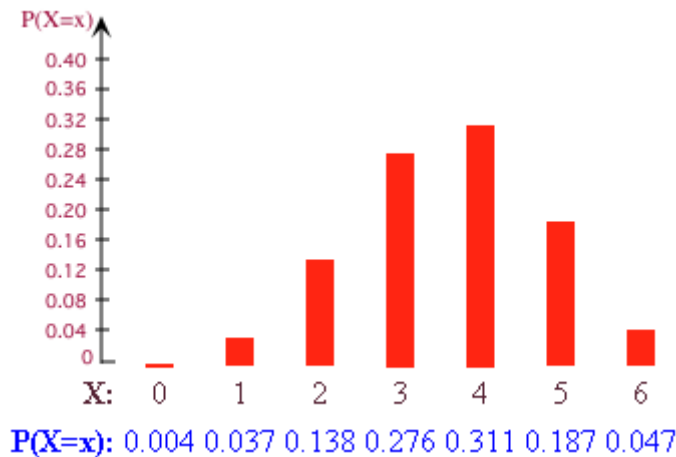
➢ A salesman has a 10% chance of persuading a randomly selected person to buy his product. He calls 8 persons. What is the probability that exactly one person is persuaded?

X:	0	1	2	3	4	5	6	7	8
P(X=x):	0.43	0.383	0.149	0.033	0.005	0	0	0	0