



Probability Methods in Engineering

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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

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



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.



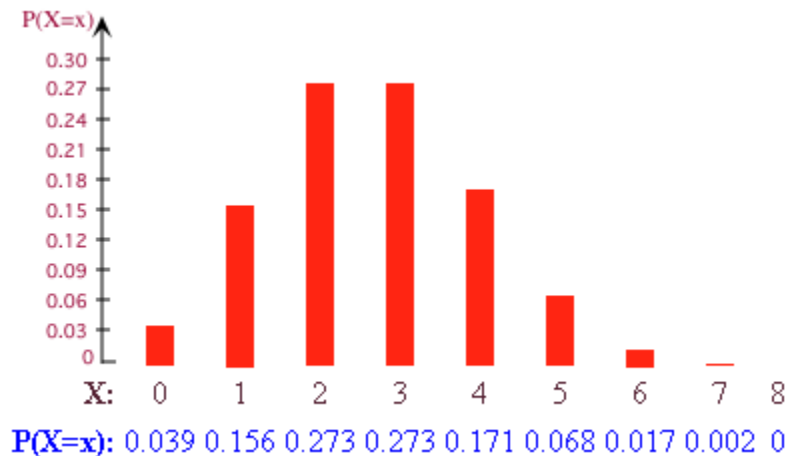
Examples (cont.)

- Verify the previous example using the binomial probability law



Examples (cont.)

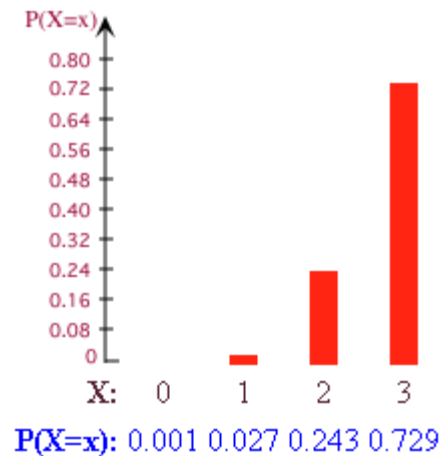
- Let k be the number of active speakers in a group of 8 speakers. Suppose that a speaker is active with probability $1/3$. Find the probability that the number of active speakers is greater than 6.





Examples (cont.)

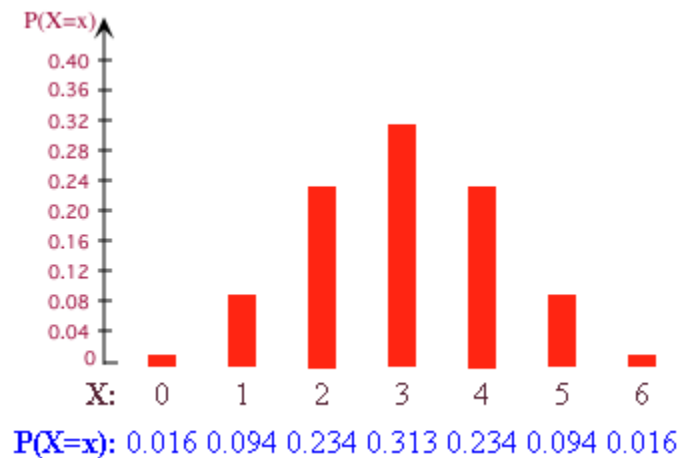
- A communication system transmits binary information over a channel that introduces random bit errors with probability $\varepsilon = 0.1$. The transmitter transmits each information bit three times, and a decoder takes a majority vote of the received bits to decide on what the transmitted bit was.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





Examples (cont.)

- What is the probability of getting heads exactly twice if you flip a fair coin 6 times?

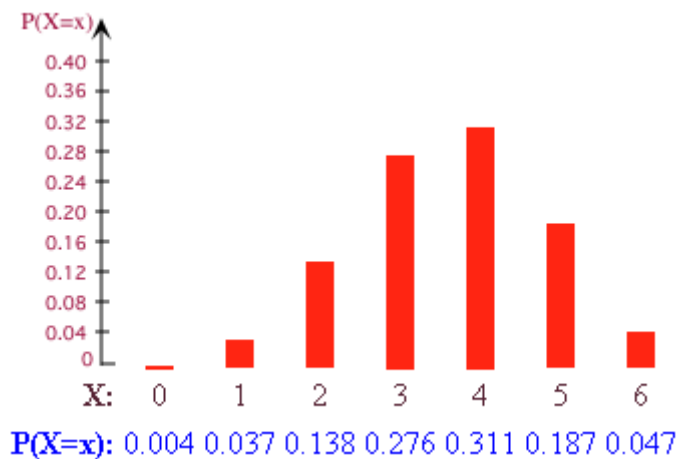


Source: http://www.zweigmedia.com/ThirdEdSite/tutstats/frames8_2.html



Examples (cont.)

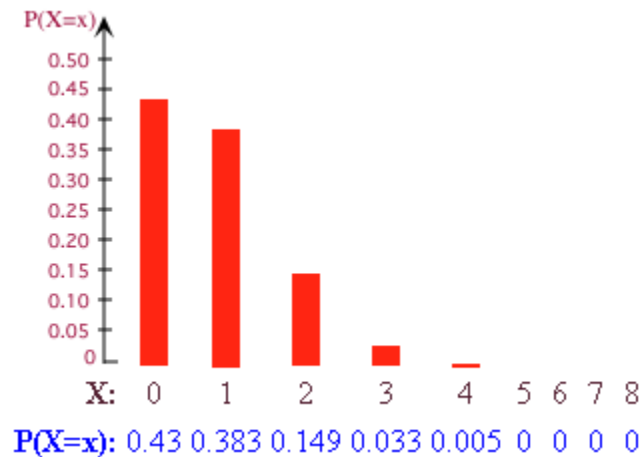
- What is the probability of getting heads more than 4 times if you flip a coin 6 times having 0.6 as the probability of heads?





Examples (cont.)

- 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?



Source: http://www.zweigmedia.com/ThirdEdSite/tutstats/frames8_2.html