

5.3 BINOMIAL EXPERIMENTS

INDEPENDENT EVENTS Two events A and B are independent if the occurrence of one does not affect the probability of the occurrence of the other.

*** #7 pg. 168

*** #8, pg. 168

TWO-NESS — BINOMIAL EXPERIMENT

- 1) The experiment has a fixed number of trials
- 2) Trials are each Independent
- 3) Each trial has 2 possible outcomes
- 4) Probabilities are constant for each trial

Determine whether these experiments are binomial:

*** #6, pg. 225

*** #10, pg. 225

*** #12, pg. 225

BINOMIAL PROBABILITY DISTRIBUTION:

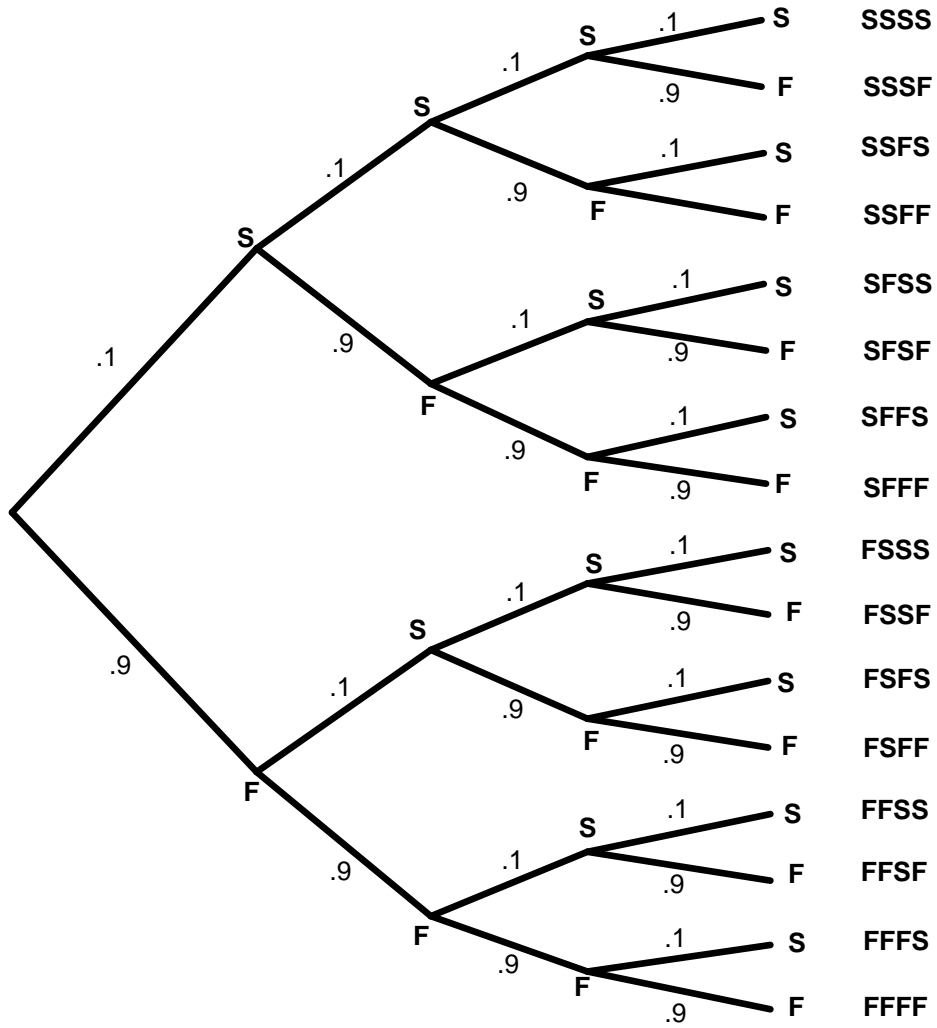
The distribution of the random variable x in a binomial experiment.

Example: The Heart Association claims that only 10% of adults over 30 in the US can pass minimum requirements established by Pres. Physical Fitness Commission. If 4 adults are randomly selected and given the fitness tests. Is this a binomial experiment?

Notation and Terminology

S	success
F	failure
$p = P(S)$	probability of success on one trial
$q = P(F) = 1 - p$	probability of failure on one trial
n	number of trials
x	number of successes in n trials
$P(x)$	probability of EXACTLY x successes in n trials

Tree diagram for a binomial experiment of 4 trials



FINDING PROBABILITIES IN A BINOMIAL EXPERIMENT

1st Method: Binomial Formula

$$P(X = x) = {}_n C_x \cdot p^x \cdot q^{n-x}$$

Text version: $\frac{n!}{x!(n-x)!} \cdot p^x \cdot q^{n-x}$

Notice: the number ${}_n C_x$ counts the number of branches in the tree diagram that have x successes and $n - x$ failures.

Evaluating ${}_n C_x$ with the calculator:

It is found in the MATH, PRB menu.

- Do some examples from the Heart Association problem given on the preceding page:
- (a) What is the probability that no one passes?

 - (b) What is the probability that exactly one passes?

 - (c) What is the probability that exactly three pass?

 - (d) Complete a Probability Distribution Table for the Heart Association problem.

x	$P(x)$

- (e) What is the probability that at least 2 pass?

- (f) What is the probability that at most 3 pass?

2nd Method: use Table A-1

Table A-1 in Appendix (page 749) shows certain p and n values

(g) What is the probability that exactly two pass?

3rd Method: Use the Calculator

2nd VARS binompdf(n,p,x)

or 2nd VARS binompdf(n,p) to get a list of all probabilities

(h) What is the probability that exactly four pass?

4th Method: Use the Program BINOMIAL83

Explore the three options:

single probability

sum of many

distribution

Practice:

***#16, pg. 226 (Use formula and check with table)

$$n = 5, x = 1, p = 0.95$$

***#22, pg. 226 (Use formula and check with calculator method 3)

$$n = 9, x = 2, p = .35$$

***#24, pg. 226 (Use formula and check with program BINOMIAL83)

$$n = 15, x = 13, p = 1/3$$

***#26, pg. 226

*****#32, pg. 227**

*****#34, pg. 227**

*****#36, pg. 227**

Additional Examples:

(1) A survey found that 30% of teenagers received their spending money from part-time jobs. If 5 teenagers are selected at random, find the probability that at least 3 of them will have part-time jobs.

(2) In random guesses, on 5 question multiple choice, what is the probability of getting EXACTLY 3 correct if each question has 4 multiple choices.

(3) In a large office building, probability of a defective phone is 0.05. If a sample of 20 are selected, find the probability

a) Exactly 5 are defective

b) at most 3 are defective

c) At least 3 are defective

(4) 10-Questions-True/False. Probability to pass if random guesses.

(5) 10-Questions-Sometimes/Always/Never. Probability to pass if random guess.

(6) 10-Questions-multiple choice of 5. Probability to pass if random guesses.

(7) What if # questions increases?

20-Questions-True/False. Probability to pass if random guesses.