

SOLUTIONS TO HOMEWORK
BINOMIAL

PROBLEM 1:

A company owns 400 laptops. Each laptop has an 8% probability of not working. You randomly select 20 laptops for your salespeople.

- (a) What is the likelihood that 5 will be broken?
- (b) What is the likelihood that they will all work?
- (c) What is the likelihood that they will all be broken?

ANS

(a) $20C5 (.08)^5 (.92)^{15} = .0145$

(b) $20C0 (.08)^0 (.92)^{20} = .1887$

(c) $20C20 (.08)^{20} (.92)^0 = .000000000000000000000001$ (note ⁻²² means move the decimal 22 places to the left)

PROBLEM 2:

A study indicates that 4% of American teenagers have tattoos. You randomly sample 30 teenagers. What is the likelihood that exactly 3 will have a tattoo?

ANS

$30C3 (.04)^3 (.96)^{27} = .0863$

PROBLEM 3:

An XYZ cell phone is made from 55 components. Each component has a .002 probability of being defective. What is the probability that an XYZ cell phone will not work perfectly?

ANS

Probability that it will work (0 defective components) $55C0 (.002)^0 (.998)^{55} = .896$

Probability that it will not work perfectly is $1 - .896 = .104$ or 10.4%

PROBLEM 4:

The ABC Company manufactures toy robots. About 1 toy robot per 100 does not work. You purchase 35 ABC toy robots. What is the probability that exactly 4 do not work?

ANS

$35C4 (.01)^4 (.99)^{31} = .00038$

PROBLEM 5:

The LMB Company manufactures tires. They claim that only .007 of LMB tires are defective. You randomly select 50 LMB tires and find 2 to be defective. What is the probability of getting 2 defective tires in this sample?

ANS

$$50C2 (.007)^2 (.993)^{48} = .0428$$

PROBLEM 6:

An HDTV is made from 100 components. Each component has a .005 probability of being defective. What is the probability that an HDTV will not work perfectly?

ANS

Probability that it will work (0 defective components) $100C0 (.005)^0 (.995)^{100} = .606$
Probability that it will not work perfectly is $1 - .606 = .394$ or 39.40%

PROBLEM 7:

Suppose that 48% of individuals 85 years and older have Alzheimer's Disease. You go to a nursing home that has been feeding residents a diet consisting of natural, organic, and healthy foods including free range chickens, omega 3 eggs, flax seed, etc. You find that only 29 of 100 residents who are 85-years and older have Alzheimer's disease? What is the likelihood of this outcome?

ANS

We will solve this problem with Excel Using BINOMDIST.

To use Excel, you need the following:

Number_S is the number of successes in n trials. For this problem = 29

Trials is the number of independent trials. For this problem = 100

Probability_S is the probability of success on each trial. For this problem = .48

Cumulative is a logical value and you indicate TRUE if you want the cumulative value or FALSE for the exact probability. For this problem, we want the individual probability of 29 "successes" from 100 so we indicate FALSE

Using Excel, Answer is $4.85327 \text{ E } -05 = .0000485327$

[The following may be of interest to those who want to do research in the future: A researcher would want to determine the cumulative probability of 0, 1, 2, 3, ..., 29. If the cumulative probability is low, then the researcher might conclude that diet has an effect on Alzheimer's disease. Please note that one would have expected to see about 48 people out of 100 with Alzheimer's disease ($p = .48$) in this nursing home; 29 is rather low. However, any value below 29 is even more unusual. We want to know the likelihood of all outcomes from

0 to 29. Certainly, finding 5 residents with Alzheimer's would have been even more unusual than 29; 0 would have been astounding!]