

Probability Problems for Exam 2

FREC 408
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PROBLEM 1 - Table Probability.

- The managers of a Fortune 500 company are surveyed to determine the education background that leads to a successful manager. Each manager was rated as either Good, Fair, or Poor. The manager's education background was also noted (Advanced Degree means Masters or Ph.D.). The data are given in the table below.

MANAGER RATING	EDUCATION LEVEL				TOTAL
	HIGH SCHOOL	SOME COLLEGE	4 YEAR COLLEGE	ADVANCED DEGREE	
GOOD	4	6	44	24	78
FAIR	10	30	90	44	174
POOR	6	16	18	28	68
TOTAL	20	52	162	96	320

Probability with Tables

- What is the probability of getting a Good Rating and being a College Graduate (regardless of degree level)?

MANAGER RATING	EDUCATION LEVEL				TOTAL
	HIGH SCHOOL	SOME COLLEGE	4 YEAR COLLEGE	ADVANCED DEGREE	
GOOD	4	6	44	24	78
FAIR	10	30	90	44	174
POOR	6	16	18	28	68
TOTAL	20	52	162	96	320

Answer

- $P(\text{Good} \cap \text{College Grad}) =$
 - $(44 + 24)/320 = .2125$ or $.213$

Probability with Tables

- What is the probability of getting a Good Rating given you have an Advanced Degree?

MANAGER RATING	EDUCATION LEVEL				TOTAL
	HIGH SCHOOL	SOME COLLEGE	4 YEAR COLLEGE	ADVANCED DEGREE	
GOOD	4	6	44	24	78
FAIR	10	30	90	44	174
POOR	6	16	18	28	68
TOTAL	20	52	162	96	320

Answer

- $P(\text{Good} | \text{Advanced Degree}) =$
 - $(24)/(96)$
 - $24/96 = .25$

Probability with Tables

- What the odds of getting a good rating (versus not a good rating) for college grads? For non-college grads? What is the odds ratio and interpret this?

MANAGER RATING	EDUCATION LEVEL				TOTAL
	HIGH SCHOOL	SOME COLLEGE	4 YEAR COLLEGE	ADVANCED DEGREE	
GOOD	4	6	44	24	78
FAIR	10	30	90	44	174
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TOTAL	20	52	162	96	320

Answer

- What the odds of getting a good rating (versus not a good rating) for college grads?
 - $(44+24)/(90+44+18+28) = 68/180 = .37778$
- For non-college grads?
 - $(4+6)/(10+30+6+16) = 10/62 = .16129$
- What is the odds ratio and interpret this?
 - $.37778/.16129 = 2.34$
 - Managers with a college degree were twice as likely to get a good rating (versus a fair or poor rating) when compared to managers without college degrees

PROBLEM 2 - Normal Distribution.

- Assume a variable is distributed normally with a mean = 75 and a standard deviation of 10. Answer the following questions.
 - What proportion of the cases are greater than 88?
 - What proportion of the cases fall between 60 and 80?

Answer

- What proportion of the cases are greater than 88?
 - $Z = (88 - 75)/10 = 1.3$
 - Use table to find probability = .4032
 - Solution: $.5 - .4032 = .0968$

Answer

- What proportion of the cases fall between 60 and 80?
 - $Z = (80 - 75)/10 = .5$
 - $Z = (60 - 75)/10 = -1.5$
 - Use table to find probability = .1915
 - Use table to find probability = .4032
 - Solution: $.1915 + .4032 = .5947$

PROBLEM 3 - Binomial Distribution

- An automobile manufacturer has determined that 30% of all gas tanks on a 1998 compact model were defective. One dealer sold 15 of these compact cars in 1998. (Note: for this problem X = the number of cars that are defective out of $n= 15$)
 - If 15 cars are recalled by the dealer, what is the probability that more than 5 of the cars will have a defective tank?
 - What is that probability that exactly 3 of the 15 cars will have a defective tank.

Answer

- If 15 cars are recalled by the dealer, what is the probability that more than 5 of the cars will have a defective tank?
 - Solution: Use the binomial table for $n=15$, $p=.3$
 - The cumulative value for 5 is .7216
 - The answer is $1 - .7216 = .2784$

Answer

- What is that probability that exactly 3 of the 15 cars will have a defective tank.
 - Solution: Use the binomial table for $n=15$, $p=.3$
 - The cumulative value for 3 is .2969
 - The cumulative value for 2 is .1268
 - The answer is $.2969 - .1268 = .1701$
- I could have also used the binomial formula to solve for exactly 3 = .17004

Binomial

- Calculate the mean, variance and standard deviation for this problem.
 - Mean
 - Variance
 - Standard Deviation

Answer

- Calculate the mean, variance and standard deviation for this problem.
 - Mean = $n \cdot p = 15 \cdot .3 = 4.5$
 - Variance = $n \cdot p \cdot q = 15 \cdot .3 \cdot .7 = 3.15$
 - Standard Deviation = 1.775