# Mktg 301 college essay

7) Data from a small bookstore are shown in the accompanying table. The manager wants to predict Sales from Number of Sales People Working. Number of sales people working| Sales (in $1000)| 4| 12| 5| 13| 8| 15| 10| 16| 12| 20| 12| 22| 14| 22| 16| 25| 18| 25| 20| 28| x= 11. 9| y= 19. 8| SD(x)= 5. 30| SD(y)= 5. 53| a) Find the slope estimate, b1. Use technology or the formula below to find the slope. b1= rsysx Enter x, y Data in TI-84 under STAT > STAT > CALC > 8: LinReg(a+bx) b1= 1. 023 b) What does b1 mean, in this context?

The slope tells how the response variable hanges for a one unit step in the predictor Thus, an additional; $1, 023 of sales associated with each additional sales person working. c) Find the intercept, b0. b0= y-b1x = 19. 8-1. 023(11. 9) For this problem, use technology, rounding to three decimal places. b0= 7. 622 d) What does b0 mean in this contet? Is it meanful? The intercept serves as a starting value for the predicitons. It shuld only be interpreted if a 0 value for the predictor variable makes sense for the context of the situation. On average, $7, 622 is expected when 0 sales people are working.

It is not meaningful because it does not make sense in this context. e) Write the equation that predicts Sales from Number of Sales People Working. Recall that the slope of the equation b1= 1. 023 and the intercept is b0= 7. 622 Complete the equation. Sales= 7. 622+1. 023 *(Number of Sales People Working) f) If 19 people are working, what sales do you predict? Substitute 19 for the number of sales people working in the equation found in the previous step and solve for Sales. Sales= 7. 622+1. 023 *(Number of Sales People Working) = 7. 622+1. 023*19Substitute. = 27. 059Simplify. *Note that each unit of Sales represents $1000. Thus, the predicted sales for 19 people working is 27, 059 dollars. g) If sales are actually $26, 000, what is the value of the residual? Subtract the predicated value found in the previous step from the actual value. 26, 000-27, 059=-1059 Thus, the value of the residual is -1059 dollars. h) Have the sale been overestimated or underestimated The predicted sales are $27, 059 and the actual sales are $26, 000. Since $27, 059 > $26, 000, the sales were overestimated. 13) Of the 46 individuals who responded, 25 are concerned, and 21 are not concerned. of those concerned about security are male and 5 of those not concerned are male. If a respondent is selected at random, find each of the fallowing conditional probabilities. | Male| Female| Total| Concerned| 9| 16| 25| Not Concerned| 5| 16| 21| Total| 14| 32| 46| a) The respondent is male, given that the respondent is not concerned about security. P(Male| Not Concerned) = 521 = 0. 238 b) The respondent is not concerned about security, given that is female P(Not Concered| Female) = 1632 = 0. 500 c) The respondent is female, given that the respondent is concerned about security. P(Female| Concerned) = 1625 = 0. 40 14) It was found that 76% of the population were infected with a virus, 21% were without clean water, and 18% were infected and without clean water | Clean Water| | | Yes| No| Total| Infected| 0. 58| 0. 18| 0. 76| Not Infected| 0. 21| 0. 03| 0. 24| Total| 0. 79| 0. 21| 1. 00| a) What’s the probability that a surveyed person had clean water and was not infected? . 21 had clean water and was not infected 15) A survey concluded that 54. 4% of the households in a particular country have both a landline and a cell phone, 32. 6% have only cell phone services but no landline, and 4. 6% have no telephone services at all. ) What proportion of households have a landline? Begin by making a contingency table. | Cell

Phone| | | Yes| No| Total| Landline| 0. 545| 0. 083| 0. 628| No Landline| 0. 326| 0. 046| 0. 372| Total| 0. 871| 0. 129| 1. 00| The completed contingency tables shows that P(landline) = 0. 628. b) Are having a cell phone and having a landline independent? Explain. Events A and B are independent when P(B| A) = P(B). To determine wheter having a cell phone and having a landline are indepented, find P(landline| cell phone) and P(landline). Recall from part a) that P(landline) = 0. 628 PBA= P(A and B)P(A)

Use the formula to find P(landline| cell phone) Plandlinecell phone= P(landline and cell phone)P(cell phone) Since the contingency table shows that P(landline and cell phone)= 0. 545 and P(cell phone)= 0. 871, substitute these values into the equation. Divide to find the conditional probability, rounding to three decimal places. Plandlinecell phone= 0. 5450. 871= 0. 626 Thus, P(landline| cell phone)= 0. 626 and P(landline)= 0. 628. Because 0. 626 is very close to 0. 628, having a cell phone and having a landline are probably independent. Of the households surveyed, 62. 6% with cell phones had landlines, and 62. 8% of all households did. 6) A marketing agency has developed three vacation packages to promote a timeshare plan at a new resort. They estimate that 30% of potential customers will choose the Day Plan, which does not include overnight accommodations; 30% will choose the Overnight Plan, which includes one night at the resort; and 40% will choose the Weekend Plan, which includes two nights. a) Find the expected value of the number of nights that potential customers will need Vacation Package| Nights Included| Probability P(X= x)| | Day Plan| 0| 30100= 0. 3| | Overnight Plan| 1| 30100= 0. 3| | Weekend Plan| 2| 40100= 0. 4| | This, P(X= 0)= 0. 3, P(X= 1) = 0. 3, and P(X= 2)= 0. Use the formula E(X) = ? x • P(x) to detrime the expected value. E(X) = ? x • P(x) = 0(0. 3) +1(0. 3) +2(0. 4) = 1. 1 There, the expected value of the number of night potential customers will need is 1. 1 b) Find the standard deviation of the number of nights potential customers will need. The standard deviation is the square root of the variance. First, Find the Variance: To do so, find the deviation of each value of X from the mean and square each deviation. The variance is the expected value of these squared deviations and is found using the formula below. ?? = Var(X) = ? (x – μ)? P(x) Find the deviation for each value of X.

Remember that E(x)= 1. 1 Vacation Package| Nights Included| Probability P(X= x)| Deviation (x – E(X))| Day Plan| 0| 30100= 0. 3| 0 – 1. 1 = -1. 1| Overnight Plan| 1| 30100= 0. 3| 1 – 1. 1 = -0. 1| Weekend Plan| 2| 40100= 0. 4| 2 – 1. 1 = 0. 9| Now find the variance using the formula ?? = Var(X)=? (x – μ)? P(x) Var(X) = ? (x – μ)? P(x) = (-1. 1)? (0. 3) + (-0. 1)? (0. 3) + (0. 9)? (0. 4) = 0. 69 Finally, the standard deviation also known as ? is the square root of the variance. ? = Var(x) = 0. 69 = 0. 83 Therefore, the standard deviation of the number of nights potential customers will need is approximately 0. 83 nights. 7) A grocery supplier believes that in a dozen eggs, the mean number of broken eggs is 0. 2 with a standard deviation of 0. 1 eggs. You buy 3 dozen eggs without checking them. a) How many broken eggs do you get? The expected value of the sum of random variables is the sum of the expected values of each idividula random variable. Find the sum of the expected values where X is the total number of broken eggs in the three dozen, and X, X, X Represent the three individual dozen eggs. E(X) = E(X1) + EX2+ EX3 = 0. 2 + 0. 2 + 0. 2 = 0. 6 Therefore, the expected value of X is 0. 6 eggs. b) What’s the standard deviation?

The variance of the sum of independent variables is the sum of their individual variances. Find the variance for each carton, add the variances, and then take the square root of the sum to find the standard deviation. The variance of each individual dozen is the square of each dozens standard deviation. Var(X1) = Var(X2) = Var(X3) = 0. 12= 0. 01 Find the sum of the variances to find the variance of the sum. Var(X) = VarX1+ VarX2+ VarX3 = 0. 01 + 0. 01 + 0. 01 = 0. 03 Recall that the standard deviation is the square root of the variance. Find the standard deviation. SD(X) = Var(x) = 0. 03 = 0. 17

Therefore, the standard deviation is 0. 17 eggs c) What assumptions did you have to make about the eggs in order to answer this question? The variance for the sum of random variables is only the sun of variances of each random variable in certain cases. Review the assumption that must be made to allow the variance to be the sum of the individual variances. 18) An insurance company estimates that it should make an annual profit of $260 on each homeowner's policy written, with a standard deviation of $6000. a) Why is the standard deviation so large? Home insurance is used to protect the owner financially in the event of a problem.

If a catastrophe occurs, then the insurance company will cover the cost of the damage. If a catastrophe never occurs, then the insurance company pays nothing. Meanwhile, the owner pays the insurance company at regular intervals whether or not a catastrophe occurs. The expected value is the mean annual profit on all of the policies and the standard deviation is a measure of how much annual profits can differ from the mean. Use this information with the fact that claims are rare, but very costly, occurrences.

b) If the company writes only four of these policies, what are the mean and standard deviation of the annual profit?

LetX1, X2, X3,..., Xn represent the annual profit on the n policies and let X be the random variable for the total annual profit on n polices written. X= X1+X2+ X3+...+Xn The expected value of the sum is the sum of the expected values. Find the expected value of the annual profit on each policy. EX1= EX2= EX3= EX4=$260 Now find the sum of the expected values. EX= EX1+EX2+EX3+EX4 = 260+260+260+260 = $1040 Therefore, the mean annual profit is $1040 To find the standard deviation of the annual profit, use the fact that te variances of the sum of independent variables is the sum of their individual variances. First find the variance for each policy.

The variance for the policy is the square of the standard deviation. VarX1= VarX2= VarX3= VarX4= 60002= 36, 000, 000 VarX= VarX1+VarX2+VarX3+VarX4 = 4(36, 000, 000) = 144, 000, 000 Evaluate the square root of the variance to find the standard deviation. SDX= VarX = 144, 000, 000 =$12, 000 Therefore, the standard deviation is $12, 000 c) If the company writes 10, 000 of these policies, what are the mean and standard deviation of annual profit? The expected value of the sum is the sum of the expected values. The expected value of each policy was found earlier. EX1= EX2= EX3=... = EX10, 000=$260 Now find the sum of expected values. EX= EX1+EX2+EX3+... +EX10, 000 10, 000(260) =$2, 600, 000 Therefore, the mean annual profit is $2, 600, 000 To find the standard deviation of the annual profit, use the fact that the variance of the sum of independent variables is the sum of their individual variances. First find the variance for each policy. The variance for the policy is the square of the standard deviation and was found earlier. VarX1= VarX2= VarX3= … = VarX10, 000= 36, 000, 000 Now sum the variances to find the variances of the sum. VarX= VarX1+VarX2+VarX3+… +VarX10, 000 = 10, 000(36, 000, 000) = 360, 000, 000, 000 Evaluate the square root of the variance to find the standard deviation. SDX= Var(X) = 360, 000, 000, 000 $600, 000 Therefore, the standard deviation is $600, 000. d) Do you think the company is likely to be profitable? Recall that the mean annual profit for 10, 000 policies is $2, 600, 000. While this number seems quite large, it is necessary to determine how likely a profit is to ensure that this company will be profitable. Find the distance in standard deviation of $0 from the mean to determine how rare an occurrence of no profit would be. z= x-?? = 0-2, 600, 000600, 000 =-4. 3 Thus, $0 is 4. 3 standard deviation below the mean. **Note that approximately 95% of the annual profits should lie within two standard deviations of the mean.

Evaluate whether the distance of $0 from the mean is convincing enough to determine whether or not the company will be profitable. e) What assumptions underlie your analysis? Can you think of circumstances under which those assumptions might be violated? The variance of the sum of random variables is only the sum of the variances of each random variables in certain cases. Review the assumption that must be made to allow the variance to be the sum of the individual variances. Then chose the situation that would create an association among policy losses. 19) A farmer has 130 lbs. of apples and 60 lbs. f potatoes for sale. The market price for apples (per pound) each day is a random variable with a mean of 0. 8 dollars and a standard deviation of 0. 4 dollars. Similarly, for a pound of potatoes, the mean price is 0. 4 dollars and the standard deviation is 0. 2 dollars. It also costs him 5 dollars to bring all the apples and potato’s to the market. The market is busy with shoppers, so assume that he’ll be able to sell all of each type of produce at the day’s price. a) Define your random variables, and use them to express the farmer’s net income. A random variable’s outcome is bases on a random event.

Therefore let the random variables represent the factors that will be randomly determined each day. The random variables should represent the market prices of the two items. A = price per pound of apples P = price per pound of potatoes The profit is equal to the total income minus the total cost. The income is found by multiplying the market price for apples by the total number of pounds sold and adding it to the product of the market price for potatoes and the number of pounds of potatoes sold. The total cost is the transparent cost. Profit = 130A + 60P – 5 b) Find the mean. The mean of the net income is the expected value of the profit.

Profit = 130A + 60P – 5 E(Proft) = E(130A + 60P – 5) Use the property E(X + Y) = E(X) + E(Y) to express the expected value of the profit as the sum of two separate expected values E=(Profit) = E(130A +60P -5) = E[(130A) + (60P – 5)] = E(130A) + E(60P – 5) Now use the property EX±c= E(X)±c E(Profit) = E(130A) + E(60P – 5) = E(130A) + E(60P) – 5 Finally, use the property E(aX) = aE(X) to remove the coefficient from the expected values. E(Profit) = E(130A) + E(60P) – 5 = 130E(A) + 60E(P) – 5 Substitute the known expected values of the prices of apples and potatoes in the equation. E(Profit) = E(130A) + E(60P) – 5 E(0. 8) + E(0. 4) – 5 Evaluate the expected profit. E(Profit) = 130(0. 8) + 60(0. 4) – 5 = 123 Therefore, the mean is 123 dollars. c) Find the standard deviation of the net income. To find the standard deviation, first find the variance and then take the square root, since the properties useful in this case are in terms of variance and not standard deviation SD(Profit) = Var(Profit) = Var(130A+60P-5) First use the property Var(X + Y) = Var(X) + Var(Y) to express the variance of the profit as the sum of two separate variance Var(Profit) = Var(130A + 60P – 5) = Var[(130A) + (60P – 5)] = Var(130A) + Var(60P – 5)

Now use the property Var(X ± c) = Var(X) to simplify the second variance Vr(Profit) = Var(130A) + Var(60P – 5) = Var(130A) + Var(60P) Finally, use the property VaraX= a2VarX to restate each variance. Var(Profit) = Var(130A) + Var(60P) = 1302VarA+ 602VarP = 16, 900Var(A) + 3600Var(P) Evaluate the variance of the profit. Var(Profit) = 16, 900(0. 16) + 3600(0. 04) = 2848 Lastly, find the standard deviation, rounding to two decimal place. SD(Profit) = VarProfit = 2848 = 53. 37 Therefore, the standard deviation of the net income is 53. 37 dollars. d) Do you need to make any assumptions in calculating the mean?

Recall that the mean of the sum of two or more random variables is the sum of the means. Determine what, if any, assumptions are made to use this property. Do you need to make any assumptions in calculating the standard deviation? Recall that the variance of the sum of two random variables is only the sum of their individual variances in certain cases, Determine what, if any, assumptions are made to use this property. 20) A salesman normally makes a sale (closes) on 65% of his presentations. Assuming the presentations are independent, find the probability of the following. ) He fails to close for the first time on his sixth attempt. Use the formula below to determine the probability, where p is the probability success, q= 1 – p and X is the number of trails until the first success occurs. P(X= x) = qx-1p Find the values for p and q. **Note that in this case that a success is defined as failed to close p = 0. 35 q = 0. 65 Substitute and solve to find P(X= 6). Rounding to four decimal places P(X= 6) = qx-1p = 0. 656-1(0. 35) = 0. 0406 Therefore, the probability he fails to close for the first tie on his sixth attempt is 0. 0406 b) He closes his first presentation on his fifth attempt.

Find the values for p and q. **Note that in this case that a success is defined as making a sale p = 0. 65 q = 0. 35 Substitute and solve to find P(X = 5), rounding to four decimal places P(X= 5) = qx-1p = 0. 355-1(0. 65) = 0. 0098 Therefore, the probability he closes his first presentation on his fifth attempt is 0. 0098 c) The first presentation he closes will be on his second attempt. Find the values for p and q. Note that in this case that a success is defined as making a sale. p = 0. 65 q = 0. 35 Substitute and solve to find P(X= 2) P(X= 2) = qx-1p = 0. 352-1(0. 65) = 0. 2275

Therefore, the probability the first presentation he closes will be on his second attempt is 0. 2275 d) The first presentation he closes will be on one of his first three attempts. Use the fact that the compliment of an even is equal to 1 – P(X= x) to find the probability. The compliment event is that he will not close a sale on any of his first three attempts. Find the probability that he does not close on his first three attempts, rounding to four decimal places. 0. 353= 0. 0429 Subtract from 1 to find the probability the first presentation he closes will be on one of his first three attempts 1 – 0. 429 = 0. 9571 Therefore, the probability the first presentation he closes will be on one of his first three attempts is 0. 9571 21) College students are a major target for advertisements for credit cards. At a university, 73% of students surveyed said that they had opened a new credit card account within the past year. If that percentage is accurate, how many students would you expect to survey before finding one who had not opened a new account in the past year? First check to see that the cells are Bernoulli trials. Trials are Bernoulli if the following three conditions are satisfied. 1.

There are only two possible outcomes (called success and failure) for each trial. 2. The probability of success, denoted p, is the same on every trial. (The probability of failure, 1 – p is often denoted q. ) 3. The trials are independent There are only two possible outcomes for each trial because a student either opened a credit card account in the past year or they did not. The probability of success is the same on every trial, based on the percent given in the problem statement. The trails are independent because each student's response is not dependent on any other student's response.

Thus, the trials of surveying the students are Bernoulli trials. A geometric probability model models how long it will take to achieve the first success in a series of Bernoulli trials. Let X be the number of students that will have to be surveyed before finding the first student who did not open a credit card in the past year. The two outcomes are a student who did not open a credit card account in the past year *success) and a student who opened a credit card account in the past year (failure). The probability of a failure is given in the problem statement as q = 73% = 0. 73.

Find the probability of success by subtracting this from 1. P = 1 – 0. 73 = 0. 27 Find the expected value of X. In a geometric model, the expected value is

EX= 1p , where p is the probability of success. Round up to the nearest integer. EX= 10. 27= 4 Therefore, on average, you would expect to survey 4 students before finding one who had not opened a new account in the past year. 22) A certain tennis player makes a successful first serve 82% of the time/ Assume that each serve is independent of the others. If she serves 7 times, what's the probability she gets a) all 7 serves in? b) exactly 5 serves in? ) at least 5 serves in? d) no more than 5 serves in? The first step is to check to see that these are Bernoulli trails. The first serves can be considered Bernoulli trials. There are only two possible outcomes, successful and unsuccessful. The probability of any first serve being good is given as p = 0. 82. Finally, it is assumed that each serve is independent of the others. Next define the random variable. Each question deals with the number of serves, so let X be the number of successful serves in n = 7 first serves. Now determine which probability model is appropriate for these problems.

Recall that geometric probability models deal with how long it will take to achieve a success. A binomial probability model describes the number of successes in a specific number of trails. All the question deal with the number of successful serves so the binomial probability model Binom(7, 0. 82 is appropriate here. a) all 7 serves in? The probability that she ges all 7 serves in is P(X= 7). To use the binomial probability model Binom(n, p), use the fallowing formula, where n is the number of trials, p is the probability of success, q is the probability of failure (q = 1 – p), and X is the number of successes in n trials.

PX= x= nxpxqn – x, where nx= n! x! n-x! First substitute the correct values into the formula PX= 7= 770. 8270. 187- 7 Now simplify. P(X = 7) ? 0. 249

Therefore, the probability that she gets all 7 serves in is approximately 0. 249 binomPDF(7, . 82, 7) = b) exactly 5 serves in? The probability she gets exactly 5 serves in is P(X = 5). As in part a, use the formula PX= x= nxpxqn – x to find this probability PX= 5= 750. 8250. 187 – 5 ? 0. 252 Therefore, the probability she gets exactly 5 serves in is approximately 0. 252 binomPDF(7, . 82, 5) = c) at least 5 serves in?

To find P(at least 5 serves in), first determine and an expression that is equal to this probability. Note that the wording “ at least 5”, means 5 or more, meaning that there can 5, 6, or 7 serves in. Thus, the probability equals P(X= 5) + P(X= 6) + P(X= 7). So to find the probability that she got at least 5 serves in, evaluate. P(X= 5) + P(X= 6) + P(X= 7) = 75(0. 82)50. 187-5+76(0. 82)6(0. 18)7-6+77(0. 82)7(0. 18)7-7 ? 0. 885 Therefore, the probability she gets at least 5 serves in is approximately 0. 885 binomPDF(7, . 82, 5) + binomPDF(7, . 82, 6) + binomPDF(7, . 82, 7) = d) no more than 5 serves in?

To find P(no more than 5), first determine an expression that is equal to this probability. Note that the wondering “ no more than 5” means 5 or less, meaning that there can be 0 thru 5 successful serves. Thus, the probability equals P(X? 5). So to find the probability that there are no more than 5 serves in, evaluate P(X? 5), which is equal to P(X= 0) + P(X= 1) + … + P(X= 5), using the formula PX= x= nxpxqn – x P(X= 0) + P(X= 1) + … + P(X= 5) = 70(0. 82)00. 187-0+71(0. 82)1(0. 18)7-1 + … + 75(0. 82)5(0. 18)7-5 ? 0. 368 Therefore, the probability that there are no more than 5 serves in is approximately 0. 368 binomCDF(7, . 82, 5)