École de gestion TELFER School of Management

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Final Exam

ADM 2303. COURSE TITLE: Statistics for Management

Time 19:00hrs, Date December 9, 2013

Professors: BenAmor, Phansalker, Schillo & Wright Duration: 3 hours

FIRST NAME ..... LAST NAME ..... Student #..... Section .....

1. Books **are not** permitted. One sheet of notes, 8.5" x 11", written on both the sides is permitted.
2. Calculators **are** permitted.
3. Use the space on the question paper for rough work.

ANSWER ALL QUESTIONS ON THE CODING SHEET

ALSO PUT YOUR ANSWER AND ALL INTERMEDIATE CALCULATION AND REASONING ON THE ANSWER SHEET.

Statement of Academic Integrity

The School of Management does not condone academic fraud, an act by a student that may result in a false academic evaluation of that student or of another student. Without limiting the generality of this definition, academic fraud occurs when a student commits any of the following offences: plagiarism or cheating of any kind, use of books, notes, mathematical tables, dictionaries or other study aid unless an explicit written note to the contrary appears on the exam, to have in his/her possession cameras, radios (radios with head sets), tape recorders, pagers, cell phones, or any other communication device which has not been previously authorized in writing.

Statement to be signed by the student:

I have read the text on academic integrity and I pledge not to have committed or attempted to commit academic fraud in this examination.

Signed:_____

Note: a paper without that signed statement will not be graded and will receive a final exam grade of zero.

Questions 1-2 A decision has to be taken for the investment in one of two restaurants which will be available for sale at the same capital cost. The operating information available on the two restaurants is as follows. Here random variables 'X' and 'Y' represent the number of customers who visit the two restaurants daily. Restaurant 'A' is a regular restaurant with an average revenue of $10.00 per customer with a fixed cost of $500 per day. Restaurant 'B' is an upscale restaurant with an average revenue of $40.00 per customer with a fixed cost of $1,500.00 per day.

Restaurant A			Restaurant B	
X = xi	P[X = xi]		Y = yi	P[Y = yi]
75	0.15		40	0.10
100	0.25		60	0.20
125	0.30		80	0.40
150	0.20		100	0.20
200	0.10		120	0.10

(3 marks)Q1: What are the respective expected values of the daily profits of Restaurant A and Restaurant B. On this basis, what would be your choice: Restaurant 'A' or 'B'?

(a) $3,200.00 , $1,237.50 and Restaurant A.
(b) $737.50, $3,200.00 and Restaurant B.
(c) $1,700.00, $737.50 and Restaurant A.
(d) $737.50, $1,700.00 and Restaurant B.
(e) $1,237.50, $1,700.00 and Restaurant B.

(3 marks) Q2: What are the respective values of the Coefficient of Variation, CV, for the profits of the two Restaurants 'A' and 'B'. If the coefficient of variation, CV, of the profits is the measure of relative risk, and you are risk averse, what would be the respective CVs and your choice: Restaurant 'A' or 'B'?
(a) 0.4731, 0.5155 and Restaurant A
(b) 0.5155, 0.4731 and Restaurant B
(c) 0.2819, 0.2739 and Restaurant B
(d) 0.2739, 0.2819 and Restaurant A
(e) 0.4731, 0.2819 and Restaurant B

Questions 3-4 Investing in the stock market requires a great deal of analysis. Generally, amateur investors simply guess when they invest in. Assuming that stocks come in two varieties, 'Good' and 'Bad' and every time one invests in a new stock, the investment has the same probability of 0.3 that it will be a 'Good' one.

(1 marks) Q3: If an amateur investor invests in 10 stocks, what will be the long term average and standard deviation (SD) of the number of "Good" stocks?
(a) average=5.0 stocks and SD=2.5 stocks
(b) average=2.7 stocks and SD=1.4491 stocks
(c) average=3.0 stocks and SD=2.7 stocks
(d) average=3.0 stocks and SD=1.4491 stocks
(e) average=2.7 stocks and SD=3 stocks

(2 marks) Q4: If the amateur investor in Q3 above, wants to calculate the probability that he will have invested in at least 3 'Good' stocks, what value should (s)he obtain?
(a) 0.6172
(b) 0.3828
(c) 0.2668
(d) 1.0000
(e) 0.6496

Questions 5-7 Service calls for repairing computers come at an average rate of 0.75 calls per hour.

(2 marks) Q5: Calculate the probability that there will be at least one call in the first two hours.
(a) 0.7769
(b) 0.2231
(c) 0.3347
(d) 0.6653
(e) 0.9830

(2 marks) Q6: In the first hour there was one service call. What is the probability that in the two following hours, there will be excatly 2 calls?
(a) 1.000
(b) 0.7490
(c) 0.2510
(d) 0.1255
(e) 0.8745

QUESTION 7 IS ON THE RIGHT -→

(2 marks) Q7: What is the probability that the waiting time for the next call will be 1hr and 20 min or less?
(a) 0.5276
(b) 0.6321
(c) 0.4724
(d) 0.3679
(e) Cannot be found.

QUESTIONS 8-14. Canadian Trade Agreements

In October 2013, the government announced a trade deal between Canada and the European Union that is forecast to increase Canada's GDP by between 0.18% and 0.36% in 2020. Canada already has a trade deal with some Latin American countries that is forecast to increase Canada's GDP by between 0.08% and 0.19% in 2020. Assume these forecasts are Normally distributed and that the probability of the GDP rising by an amount inside the given range is 0.9.

(1 mark) Q8 What is the standard deviation of the forecast of the increase in Canada's GDP due to the deal with the European Union?

(a) 0% – 0.025%
(b) 0.025% - 0.05%
(c) 0.05% - 0.075%
(d) 0.075% - 0.1%
(e) >0.1%

(1 mark) Q9 What is the standard deviation of the forecast of the increase in Canada's GDP due to the deal with the Latin American countries?

(a) 0% – 0.025%
(b) 0.025% - 0.05%
(c) 0.05% - 0.075%
(d) 0.075% - 0.1%
(e) >0.1%

In order to prevent errors in Q1 and Q2 affecting Q3 to Q7, we will use different values for the standard deviations from now on. Independent of your answers to Q1 and Q2, ***from now on assume that*** the SD for the forecast due to the EU deal is 0.062% and the SD for the forecast due to the Latin American countries deal is 0.024%.

(1 mark) Q10 What is the probability that the deal with the European Union will increase Canada's GDP by more than 0.33% in 2020?

(a) 0 – 0.05
(b) 0.05 – 0.1
(c) 0.1 – 0.15
(d) 0.15 – 0.25
(e) 0.25 – 1

(2 marks) Q11 What is the probability that the deal with the European Union will increase Canada's GDP in 2020 by less than the deal with the Latin American countries? Assume that the effects of the two deals on Canada's GDP are independent.

(a) 0 – 0.05
(b) 0.05 – 0.1
(c) 0.1 – 0.15
(d) 0.15 – 0.25
(e) 0.25 – 1

(3 marks) Q12 Assuming that the effects of the two deals on Canada's GDP are correlated with a correlation coefficient of 0.26, we are interested in the total effect on Canada's GDP in 2020 of both the European Union deal and also the deal with the Latin American countries. What is the range within which we are 90% sure Canada's GDP will increase?

(a) Between 0.26% and 0.53%
(b) Between 0.28% and 0.53%
(c) Between 0.28% and 0.58%
(d) Between 0.29% and 0.52%
(e) Between 0.24% and 0.56%

(1 mark) Q13 Calculate the first quartile of the forecast increase in GDP by 2020 for the deal with the European Union.

(a) < 0.18%
(b) 0.18% - 0.22%
(c) 0.22% - 0.24%
(d) 0.24% - 0.26%
(e) > 0.26%

(3 marks) Q14 On the answer sheet, draw a box and whiskers plot for the forecast increase in GDP by 2020 due to the European Union deal alone. Just show the box and whiskers (the whiskers extend right up to the fences). Do NOT show any outliers. On the coding sheet, give the value for the high end of the upper whisker/fence.

(a) 0.34% - 0.36%
(b) 0.36% - 0.38%
(c) 0.38% - 0.40%
(d) 0.40% - 0.42%
(e) > 0.42%

QUESTIONS 15-19. Solar Power in Ottawa

The amount of electric power generated by solar panels varies throughout the day according to the position of the sun in the sky and also depends on the amount of clouds. In general more power is generated in the middle of the day. The revenue generated by selling this power, therefore also varies through the day. The revenues generated each hour of one day in July 2013 from a solar installation in Ottawa are given in the table. For instance from 6.00am to 7.00am the installation generated $4.85 of revenue. The mean and standard deviation of these hourly revenues are $4.88 and $2.65 respectively.

Revenue	$0.07	$2.21	$4.17	$4.85	$6.24	$7.19	$7.80	$7.98	$7.90	$7.38	$6.53	$5.31	$3.77	$4.17	$2.51	$0.01
Hour ending	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00

(1 mark) Q15 On the answer sheet, draw a line graph of the revenue on the vertical axis and the "hour ending" on the horizontal axis. On the coding sheet give the ***approximate*** shape of the graph.

(a) Linear increase throughout
(b) Similar to an Exponential Distribution
(c) Similar to a Normal Distribution with the tails cut off
(d) Similar to a Binomial Distribution
(e) Similar to a Uniform Distribution

(3 marks) Q16 On the answer sheet, draw a histogram of the revenue, using 4 bars (sometimes called bins, groups, classes). On the coding sheet indicate the shape of the histogram.

(a) Similar to a Normal Distribution
(b) Similar to a Binomial Distribution
(c) Similar to a Uniform Distribution
(d) Skewed
(e) Symmetric

(1 mark) Q17 Is the mean revenue higher than the median revenue? You are NOT asked to calculate the median. You are just asked whether one is higher than the other. You can base your answer on the shape of the graph(s) you have just drawn. Alternatively you can calculate the median if you prefer.

(a) The mean does not exist for this data
(b) The median does not exist for this data
(c) The median and the mean are the same
(d) The mean is higher than the median
(e) The median is higher than the mean

(1 mark) Q18 Calculate the 70^{th} percentile of the revenue.

(a) < $3.00
(b) $3.00 - $4.00
(c) $4.00 - $5.00
(d) $5.00 - $6.00
(e) $6.00 - $8.00

(2 marks) Q19 A salesperson for solar panels publishes a brochure based on the information in this question. It states that "during the course of a day in July the hourly revenue will vary with a mean of $4.88." Since the standard deviation of hourly revenues is $2.65, the salesperson adds two standard deviations and states in the brochure: "There is a 5% chance of getting over $10.18 per hour in July." Comment on the ethics of this salesperson's statements. Give the reason for your answer on the answer sheet.

(a) Encouraging people to buy solar panels is good for the environment and therefore the ASA ethical guidelines are not infringed
(b) Infringes item A of the ASA ethical guidelines
(c) Infringes item C of the ASA ethical guidelines
(d) Infringes item H of the ASA ethical guidelines
(e) Infringes both items A and C of the ASA ethical guidelines

Questions 20-24 Canadian Senate

The Canadian Senate typically has 105 seats, but usually a small number of these seats are vacant (currently 7). The distribution of the 98 senators by party is as follows:

	No. of Senators	Percent
Conservative Party	59	60.2%
Liberal Party	33	33.7%
Independent	6	6.1%
	98	100%

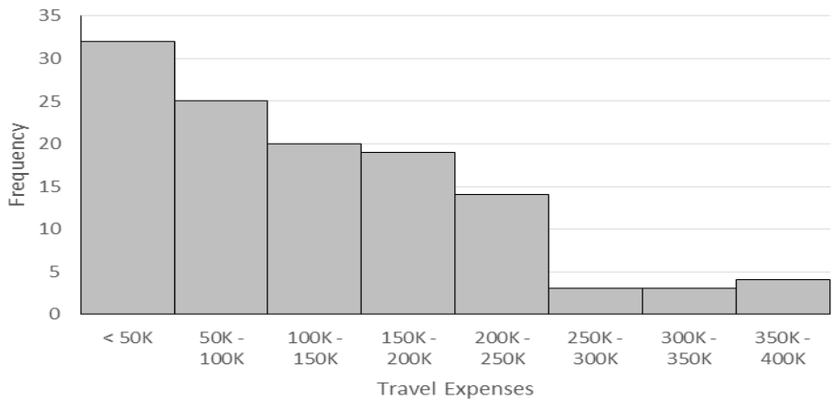
As you probably heard on the news, 4 senators are under investigation for various expense claims. 3 of the 4 senators are Conservative Party members, i.e. 75%.

(2 marks) Q20 A reporter looks at these percentages and wonders whether a random sample of 4 senators would be likely to have a percentage of 75% Conservative senators or whether a different conclusion can be drawn from these data. He calculates a sampling distribution as follows: μ=0.602, σ=sqrt(0.602*0.389/4)=0.242, z=(0.75-0.602)/0.242 and comes to the conclusion that the probability of a random sample of 4 senators containing 75% or more Conservative Senators is approximately 27%. Which of the following statements matches this situation most closely with regards to Ethics Rule A - Professionalism?

(a) The calculations are correct, there is no issue with Professionalism (A).
(b) The calculations for the sampling distribution are reasonably correct but these calculations are inapplicable in this situation, and so, Professionalism (A) is violated.
(c) The calculation of mean and standard deviation is incorrect, thus Professionalism (A) is violated.
(d) The calculation of mean and s.d. is correct, but there is an error in the calculation of the probability, thus Professionalism (A) is violated.
(e) The calculations and assumptions are correct, but the statement of the conclusion is incorrect, thus Professionalism (A) is violated.

(1 mark) Q21 Now, disregard the previous answer and answer the following question independently of your previous answer. Assume you have made your own calculations and correctly calculated that the probability that a random sample of 4 senators contains 3 or more Conservative senators is 48%. Using our usual decision criteria, what conclusions can you draw regarding Conservative Senators in general?
(a) We have evidence that Conservative Senators are more corrupt than other Senators.
(b) We have evidence that Conservative Senators are more likely to be under investigation than other Senators.
(c) We have no evidence that Conservative Senators are more corrupt or more likely to be under investigation than other Senators.
(d) We have evidence that Conservative Senators are no more corrupt than other Senators.
(e) None of the above.

For one of the senators, the expenses under investigation are travel expenses. A different news article reports data on travel expenses over the time period from November 30, 2010 to November 2012. Note that there was some turnover of Senators in that time period, so there are expense claims for 120 Senators, with an average of $119,557, a standard deviation of $90,070, and the following histogram:



(3 marks) Q22 Suppose a journalist reports on a sample of 33 Senators with an average of $89,557 in travel expenses. What is the probability that a random sample of 33 Senators would have this average or lower?
(a) <5%
(b) 5% - 16%
(c) 16% - 84%
(d) 84% - 95%
(e) >95%

(2 mark) Q23 What can we conclude from this finding?

(a) This sample is not likely to be different from other samples of Senators.
(b) This is a group of Senators that clearly has lower expenses than other Senators.
(c) There is reason to believe that these Senators are not randomly picked.
(d) (b) or (c) could be true.
(e) We can't really conclude any of the above.

(2 marks) Q24 Applied to this case, the Central Limit Theorem states that:

(a) The sample of 33 Senators will have a normal distribution of travel expenses.
(b) If selected at random, the sample of 33 Senators will have a normal distribution of travel expenses.
(c) If selected at random, the means of samples of 33 Senators will have a normal distribution.
(d) If selected at random, the sample mean will be the population mean.
(e) It can't be applied to this situation.

Questions 25-29

According to a survey, 16% of the population likes tangerines. However, these figures vary by region. For example, in B.C. the figure is 20% and in Manitoba the figure is 17%. Sixteen percent of the Canadian population in general is in B.C. and 3.7% of the Canadian population is in Manitoba. Suppose a Canadian is chosen randomly.

(1 mark) Q25 The above listed figures are obtained using:

(a) Theoretical probability assessment
(b) Subjective probability assessment
(c) Relative frequency of occurrence (empirical probability assessment)
(d) Binomial probability assessment
(e) Contingency analysis

(2 marks) Q26 Suppose the chosen person is known not to like tangerines. The probability that the person lives in Manitoba is:

(a) Between 3.50% and 4.00%
(b) Between 3.00% and 3.50%
(c) Between 7.50% and 8.50%
(d) Between 9.50% and 10.50%
(e) >17.00%

(3 marks) Q27 Suppose the chosen person is known to like tangerines. The probability that the person lives neither in B.C. nor in Manitoba is:

(a) Between 3.50% and 4.00%
(b) Between 3.00% and 3.50%
(c) Between 28.50% and 29.50%
(d) Between 75.50% and 76.50%
(e) >77.00%

(3 marks) Q28 Suppose now that 2 Canadians are chosen randomly. The probability that both these people either are from BC or like tangerines is:

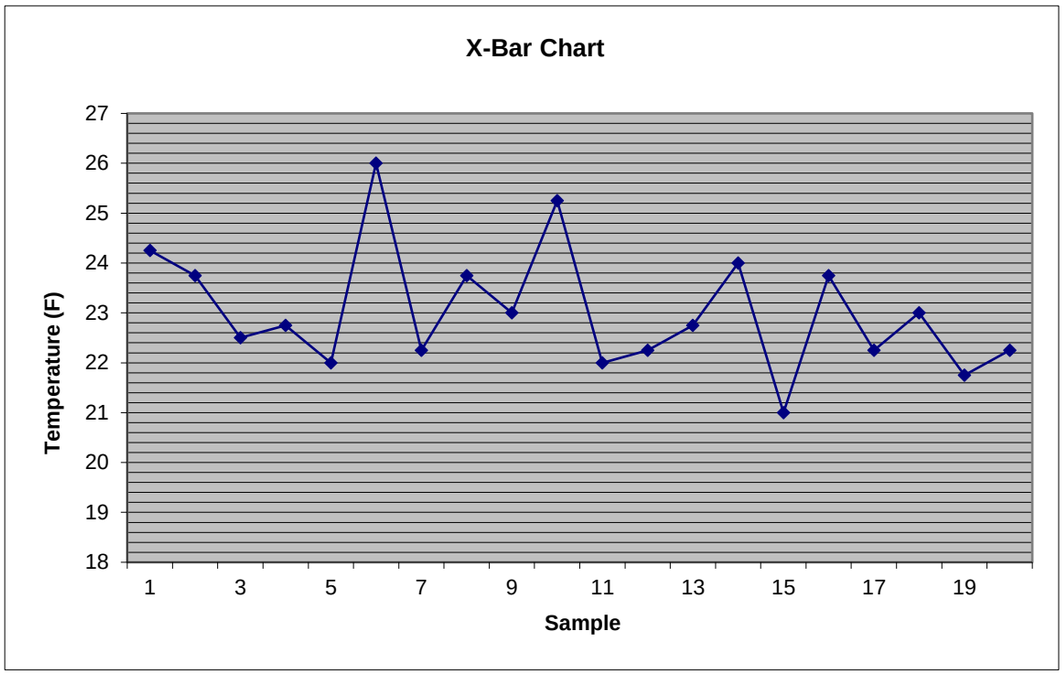
(a) Between 3.50% and 4.00%
(b) Between 7.50% and 8.50%
(c) Between 15.50% and 16.50%
(d) Between 28.50% and 29.50%
(e) >32.00%

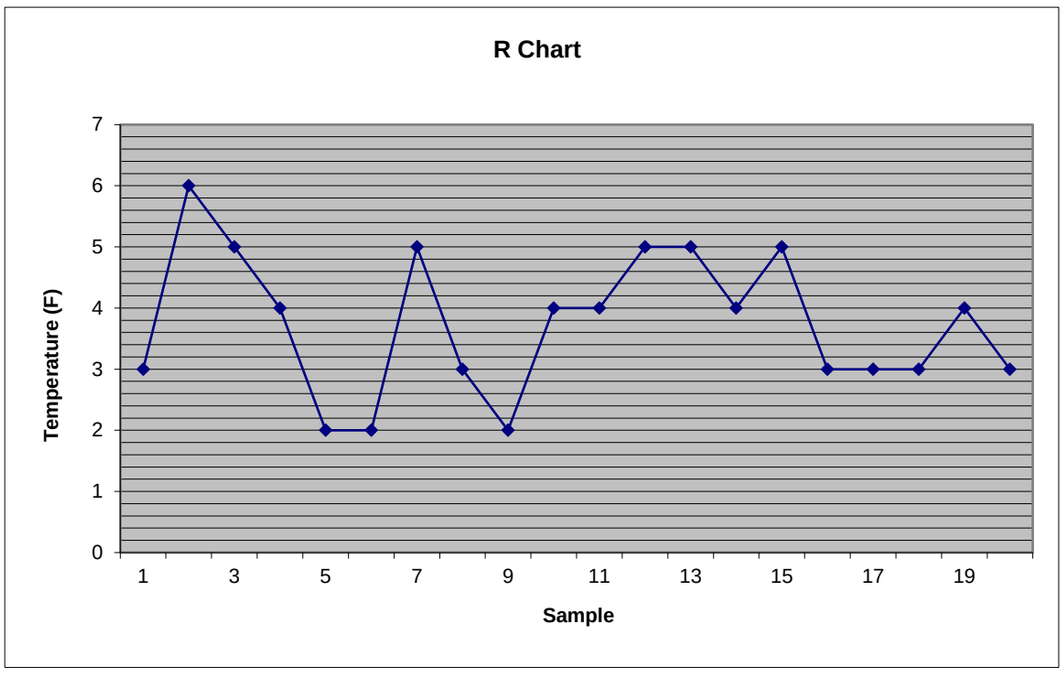
(2 marks) Q29 The events 'like tangerines' and 'live in B.C' are:

(a) Independent and mutually exclusive
(b) Dependent and mutually exclusive
(c) Independent and not mutually exclusive
(d) Dependent and not mutually exclusive
(e) None of the above

Questions 30-34

The temperature control unit on a commercial freezer in a 24-hour grocery store is set to maintain a certain temperature. The actual temperature varies, because people are constantly opening the freezer door to remove items. The manager of the grocery store wants to study the temperature variation for his freezer using process control charts. Temperature measurements are recorded at 4 locations in the freezer, once an hour for 20 hours. Data for these 20 samples of four observations are summarized in the following graphs of the average freezer temperature (X-bar) and range (R).





Over the 20 samples, the average of X-Bar (i.e. X-bar-bar) is 23.025 degrees Fahrenheit and the average of R (i.e. R-bar) is 3.75 degrees Fahrenheit.

(2 marks) Q30 Using the Table of Shewhart (or control chart) factors, the upper and lower control limits for X-Bar are (in degrees Fahrenheit):

(a) 25.76 and 20.29
(b) 25.76 and 0
(c) 26.00 and 18.00
(d) 26.00 and 21.00
(e) Cannot be calculated

(2 marks) Q31 Using the Table of Shewhart (or control chart) factors (below), the upper and lower control limits for R are (in degrees Fahrenheit):

(a) 9.00 and 0
(b) 6.01 and 2.00
(c) 8.55 and 0
(d) 9.00 and 2.00
(e) Cannot be calculated

(2 marks) Q32 Use statistical quality control rules and draw appropriate lines on the above control charts to answer this question. The system is :

(a) In control and uncontrollable
(b) in control and controllable
(c) Out of control and uncontrollable
(d) Out of control and controllable
(e) None of the above

(2 marks) Q33 For this question, regardless your answer to question 30, assume the upper and lower control limits for X-bar are 26.10 and 21.00 degrees Fahrenheit. The mean for the freezer temperature and standard deviation are now known to be 23 and 2 degrees Fahrenheit and is Normally Distributed. The probability that a sample gives a point beyond the control limits of the X-bar chart is:

(a) <2.00%
(b) between 2.10% and 2.20%
(c) between 2.20% and 2.30%
(d) between 2.30% and 2.40%
(e) Cannot be calculated

(2 marks) Q34. In order to maintain food quality, company regulations specify that the temperature at any single location in the freezer must be between 20 and 27 degrees Fahrenheit (the mean plus/minus 3 standard deviations). Interpret the x-bar chart above for this specification:

(a) In control
(b) Out of control
(c) Controllable
(d) Uncontrollable
(e) None of the above

n	A2	A3	d2	d3	D3	D4
2	1.88	2.66	1.13	0.853	0	3.27
3	1.02	1.95	1.69	0.888	0	2.57
4	0.73	1.63	2.06	0.880	0	2.28
5	0.58	1.43	2.33	0.864	0	2.11
6	0.48	1.29	2.53	0.848	0	2.00

Table of Shewhart (or control chart) Factors