THE OPEN UNIVERSITY OF SRI LANKA
BACHELOR OF MANAGEMENT STUDIES DEGREE PROGRAMME
LEVEL 05    2010/2011
FINAL EXAMINATION 2011
QUANTITATIVE TECHNIQUES FOR MANAGEMENT II – MCU 3209

| DATE : 13.02.2011 | TIME : 1.30 pm – 4.30 pm |
|---|---|

INSTRUCTIONS
Duration: Three Hours
ANSWER ANY FIVE (05) QUESTIONS.
All questions carry equal marks.

This question paper has seven questions in five pages.
Use of a non-programmable calculator is allowed.
Normal and Chi-square tables are annexed herewith.
$e^1 = 2.71$

1.
(a) What is a Normal Distribution? Explain with suitable examples.

Highlight its important properties.

(b) The lifetime of an automotive battery is normally distributed with mean 38 months and standard deviation 9 months.
 (i)   Find the probability that lifetime of a randomly selected battery is in between 29 months and 47 months.
 (ii)  Find the probability of the lifetime of a randomly selected battery exceeds 20 months.
 (iii) In setting warranties on batteries, manufacturers want to set the time limit in such a way that few batteries will have to be refilled at the manufactures expense. However they want the buyer to have some degree of protection against manufacturing over a period of time after the purchase. The manufacturer would like to set the expiration time of the warranty at such a level that 95% batteries made will remain in working condition throughout the warranty period. What should be the warranty period?

2.
(a) Briefly explain the key properties of Binomial Distribution. Under what conditions the normal distribution can be used to approximate the binomial probabilities?

(b) Some traffic lights have three phases: *stop 45%* of the time, *wait or get ready 10%* of the time and *go 45%* of the time.

(i) Assuming that you only cross a traffic light when it is in the *go* position model the number of times that you have to *wait or stop* on your way to school given that there are 8 sets of traffic lights. State any assumptions that must be made and give possible values for the parameters.

(ii) Find the mean number of times that you have to *wait or stop* on your way to school.

(C) It was found that 10% of a particular batch of radios manufactured by a company is defective. A retailer purchased 200 of those radios from this company. What is the probability that more than 30 of them are defective?

3.

(a) The number of traffic accidents that occur on a particular stretch of road during a month follows a Poisson distribution with a mean of 9.

(i) Find the probability of observing five or more accidents on this stretch of road during next month.

(ii) Find the probability of observing exactly twelve accidents on this stretch road during next two months.

(iii) Assuming next month has 30 days find the probability of observing two to five accidents on this stretch of road during the first ten days of next month.

(b) Data given bellow shows the number of cancer patients comes per day to a particular medical clinic during a period of 100 days. Fit a Poisson model for these data.

| Number of patients | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Number of days | 40 | 32 | 18 | 9 | 1 |

4.

(a) Write Short notes on followings.

(i) Test Statistic

(ii) Critical region

(iii) Significance level

(b) An inventor has developed a new, energy-efficient lawn mower engine. He claims that the engine will run continuously for 5 hours (300 minutes) on a single gallon of regular gasoline. To test inventor's claim a simple random

sample of 25 engines are tested. The engines run for an average of 295 minutes. Assume that run times for the population of engines are normally distributed and with standard deviation of 20 minutes.

(i) Construct 95% confidence interval for the mean runtime of the engine on a single gallon of regular gasoline. Comment on the inventor's claim.

(ii) Suppose you are asked to conduct a statistical test to test the inventor's claim

   I Clearly sate the null hypothesis and the alternative hypothesis that you should test.

   II Conduct a statistical test to test the hypothesis mention in I

   III What is your conclusion at 0.5 level of significance?

5. (a) Briefly explain the uses of Chi-square test in statistics.

   (b) In a study of the television viewing habits of children, a developmental psychologist selects a random sample of 300 first graders - 100 boys and 200 girls. Each child is asked which of the following TV programs they like best: The Punchi weerayo, Super man, or Cynderella. Results are shown in the contingency table below.

| | Viewing Preferences | | | Row total |
| --- | --- | --- | --- | --- |
| | Punchi weerayo | Superman | Cynderella | |
| Boys | 30 | 65 | 05 | 100 |
| Girls | 60 | 40 | 100 | 200 |
| Column total | 90 | 105 | 105 | 300 |

Conduct a statistical test to test whether the Viewing Preferences depend on the gender. Clearly sate your null hypothesis and alternating hypothesis. Use 0.05 level of significance.

6.   (a)   Using your knowledge on statistics comment on the following scatter plots.

(i)



(ii)



(iii)
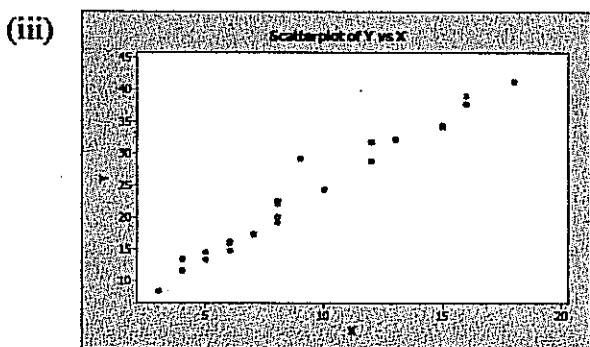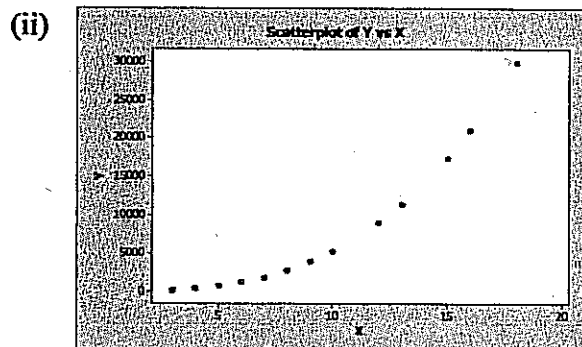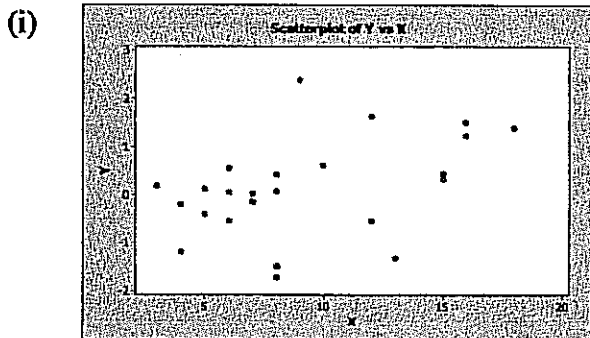


(c)   A researcher is interested in finding the effect of the reaction of the temperature to yield of a particular chemical process. For different 25 temperatures he has recorded the yield of the process. Temperature is recorded in centigrade and the yield is recorded in milligrams. Assume that the chemical amounts that used to set the each experiment are same and only the temperature is different. Using Minitab statistical package simple linear regression line was fitted to the data. A part of the statistical output is given bellow.

---

**Regression Analysis: Yield versus Temperature**

The regression equation is
Yield = 20.3 + 1.96 Temperature

Analysis of Variance

| Source | DF | Sum of squares |
|---|---|---|
| Regression | 1 | 21745 |
| Residual | 23 | 364 |
| Total | 24 | 22109 |

(i)   A student of the researcher says that "Yield is increasing with the increase of the temperature". Do you agree with the student? Justify your answer.

(ii)  Find the increase/decrease of the Yield per increase of temperature in one centigrade.

(iii) Calculate R-square and interpret it.

(iv)  Estimate the yield of the chemical process when the temperature is 65 centigrade.

7. Write Short notes on following topics

(a) Components of a time series.

(b) Coefficient of determinant

(c) One tail test and Two tail tests
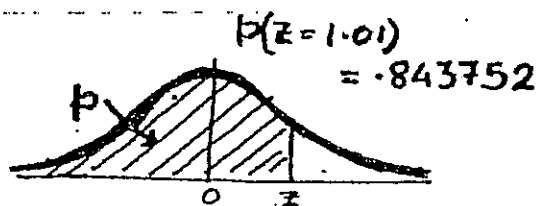
(d) Sampling errors and non sampling errors.

*(Copyrights Reserved)*

$$r = \frac{\sum xy - \frac{\sum(x).\sum(y)}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}}$$

$$b = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$$

$$a = \frac{\sum y}{n} - b.\frac{\sum x}{n}$$

## Standard normal distribution

$P(z = 1.01)$
$= .843752$

| z | .00 | .01 | .02 | .03 | .04 | .05 | .06 | .07 | .08 | .09 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | .500000 | .503989 | .507978 | .511966 | .515953 | .519939 | .523922 | .527903 | .531881 | .535856 |
| 0.1 | .539828 | .543795 | .547758 | .551717 | .555670 | .559618 | .563559 | .567495 | .571424 | .575345 |
| 0.2 | .579260 | .583166 | .587064 | .590954 | .594835 | .598706 | .602568 | .606420 | .610261 | .614092 |
| 0.3 | .617911 | .621720 | .625516 | .629300 | .633072 | .636831 | .640576 | .644309 | .648027 | .651732 |
| 0.4 | .655422 | .659097 | .662757 | .666402 | .670031 | .673645 | .677242 | .680822 | .684386 | .687933 |
| 0.5 | .691462 | .694974 | .698468 | .701944 | .705401 | .708840 | .712260 | .715661 | .719043 | .722405 |
| 0.6 | .725747 | .729069 | .732371 | .735653 | .738914 | .742154 | .745373 | .748571 | .751748 | .754903 |
| 0.7 | .758036 | .761148 | .764238 | .767305 | .770350 | .773373 | .776373 | .779350 | .782305 | .785236 |
| 0.8 | .788145 | .791030 | .793892 | .796731 | .799546 | .802337 | .805105 | .807850 | .810570 | .813267 |
| 0.9 | .815940 | .818589 | .821214 | .823814 | .826391 | .828944 | .831472 | .833977 | .836457 | .838913 |
| 1.0 | .841345 | .843752 | .846136 | .848495 | .850830 | .853141 | .855428 | .857690 | .859929 | .862143 |
| 1.1 | .864334 | .866500 | .868643 | .870762 | .872857 | .874928 | .876976 | .879000 | .881000 | .882977 |
| 1.2 | .884930 | .886861 | .888768 | .890651 | .892512 | .894350 | .896165 | .897958 | .899727 | .901475 |
| 1.3 | .903200 | .904902 | .906582 | .908241 | .909877 | .911492 | .913085 | .914657 | .916207 | .917736 |
| 1.4 | .919243 | .920730 | .922196 | .923641 | .925066 | .926471 | .927855 | .929219 | .930563 | .931888 |
| 1.5 | .933193 | .934478 | .935745 | .936992 | .938220 | .939429 | .940620 | .941792 | .942947 | .944083 |
| 1.6 | .945201 | .946301 | .947384 | .948449 | .949497 | .950529 | .951543 | .952540 | .953521 | .954486 |
| 1.7 | .955435 | .956367 | .957284 | .958185 | .959070 | .959941 | .960796 | .961636 | .962462 | .963273 |
| 1.8 | .964070 | .964852 | .965620 | .966375 | .967116 | .967843 | .968557 | .969258 | .969946 | .970621 |
| 1.9 | .971283 | .971933 | .972571 | .973197 | .973810 | .974412 | .975002 | .975581 | .976148 | .976705 |
| 2.0 | .977250 | .977784 | .978308 | .978822 | .979325 | .979818 | .980301 | .980774 | .981237 | .981691 |
| 2.1 | .982136 | .982571 | .982997 | .983414 | .983823 | .984222 | .984614 | .984997 | .985371 | .985738 |
| 2.2 | .986097 | .986447 | .986791 | .987126 | .987455 | .987776 | .988089 | .988396 | .988696 | .988989 |
| 2.3 | .989276 | .989556 | .989830 | .990097 | .990358 | .990613 | .990863 | .991106 | .991344 | .991576 |
| 2.4 | .991802 | .992024 | .992240 | .992451 | .992656 | .992857 | .993053 | .993244 | .993431 | .993613 |
| 2.5 | .993790 | .993963 | .994132 | .994297 | .994457 | .994614 | .994766 | .994915 | .995060 | .995201 |
| 2.6 | .995339 | .995473 | .995604 | .995731 | .995855 | .995975 | .996093 | .996207 | .996319 | .996427 |
| 2.7 | .996533 | .996636 | .996736 | .996833 | .996928 | .997020 | .997110 | .997197 | .997282 | .997365 |
| 2.8 | .997445 | .997523 | .997599 | .997673 | .997744 | .997814 | .997882 | .997948 | .998012 | .998074 |
| 2.9 | .998134 | .998193 | .998250 | .998305 | .998359 | .998411 | .998462 | .998511 | .998559 | .998605 |

## Chi-Squre Table:
### Values of $X^2_\alpha$.
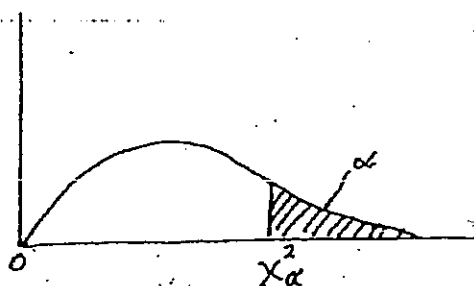
| $X^2_{.10}$ | $X^2_{.05}$ | $X^2_{.025}$ | $X^2_{.01}$ | $X^2_{.005}$ | df |
|---|---|---|---|---|---|
| 2.70554 | 3.84146 | 5.02389 | 6.63490 | 7.87944 | 1 |
| 4.60517 | 5.99147 | 7.37776 | 9.21034 | 10.5966 | 2 |
| 6.25139 | 7.81473 | 9.34840 | 11.3449 | 12.8381 | 3 |
| 7.77944 | 9.48773 | 11.1433 | 13.2767 | 14.8602 | 4 |
| 9.23635 | 11.0705 | 12.8325 | 15.0863 | 16.7496 | 5 |
| 10.6446 | 12.5916 | 14.4494 | 16.8119 | 18.5476 | 6 |
| 12.0170 | 14.0671 | 16.0128 | 18.4753 | 20.2777 | 7 |
| 13.3616 | 15.5073 | 17.5346 | 20.0902 | 21.9550 | 8 |
| 14.6837 | 16.9190 | 19.0228 | 21.6660 | 23.5893 | 9 |
| 15.9871 | 18.3070 | 20.4831 | 23.2093 | 25.1882 | 10 |
| 17.2750 | 19.6751 | 21.9200 | 24.7250 | 26.7569 | 11 |
| 18.5494 | 21.0261 | 23.3367 | 26.2170 | 28.2995 | 12 |
| 19.8119 | 22.3621 | 24.7356 | 27.6883 | 29.8194 | 13 |
| 21.0642 | 23.6848 | 26.1190 | 29.1413 | 31.3193 | 14 |
| 22.3072 | 24.9958 | 27.4884 | 30.5779 | 32.8013 | 15 |
| 23.5418 | 26.2962 | 28.8454 | 31.9999 | 34.2672 | 16 |
| 24.7690 | 27.5871 | 30.1910 | 33.4087 | 35.7185 | 17 |
| 25.9894 | 28.8693 | 31.5264 | 34.8053 | 37.1564 | 18 |
| 27.2036 | 30.1435 | 32.8523 | 36.1908 | 38.5822 | 19 |
| 28.4120 | 31.4104 | 34.1696 | 37.5662 | 39.9968 | 20 |
| 29.6151 | 32.6705 | 35.4789 | 38.9321 | 41.4010 | 21 |
| 30.8133 | 33.9244 | 36.7807 | 40.2894 | 42.7956 | 22 |
| 32.0069 | 35.1725 | 38.0757 | 41.6384 | 44.1813 | 23 |
| 33.1963 | 36.4151 | 39.3641 | 42.9798 | 45.5585 | 24 |
| 34.3816 | 37.6525 | 40.6465 | 44.3141 | 46.9278 | 25 |
| 35.5631 | 38.8852 | 41.9232 | 45.6417 | 48.2899 | 26 |
| 36.7412 | 40.1133 | 43.1944 | 46.9630 | 49.6449 | 27 |
| 37.9159 | 41.3372 | 44.4607 | 48.2782 | 50.9933 | 28 |
| 39.0875 | 42.5569 | 45.7222 | 49.5879 | 52.3356 | 29 |
| 40.2560 | 43.7729 | 46.9792 | 50.8922 | 53.6720 | 30 |
| 51.8050 | 55.7585 | 59.3417 | 63.6907 | 66.7659 | 40 |
| 63.1671 | 67.5048 | 71.4202 | 76.1539 | 79.4900 | 50 |
| 74.3970 | 79.0819 | 83.2976 | 88.3794 | 91.9517 | 60 |
| 85.5271 | 90.5312 | 95.0231 | 100.425 | 104.215 | 70 |
| 96.5782 | 101.879 | 106.629 | 112.329 | 116.321 | 80 |
| 107.565 | 113.145 | 118.136 | 124.116 | 128.299 | 90 |
| 118.498 | 124.342 | 129.561 | 135.807 | 140.169 | 100 |