The Management University of Africa

MUA

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**POST GRADUATE UNIVERSITY EXAMINATIONS**

**SCHOOL OF MANAGEMENT AND LEADERSHIP**

**DEGREE OF MASTER OF BUSINESS ADMINISTRATION/ MASTER OF MANAGEMENT AND LEADERSHIP/ MASTER OF ARTS IN DEVELOPMENT STUDIES**

**MBA 505/ MML 5102/ MDE 517:** **QUANTITATIVE TECHNIQUES FOR BUSINESS/ STATISTICAL DECISIONAL ANALYSIS/ SOCIAL STATISTICS**

**DATE:** **4TH AUGUST, 2023**

**DURATION: 3 HOURS**

**MAXIMUM MARKS: 60**

**INSTRUCTIONS:**

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **FOUR (4)** questions.
4. Question **ONE is compulsory.**
5. Answer any other **TWO** questions.
6. Question **ONE** carries **30 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided**

## QUESTION ONE

a) An entrepreneur selling teenager tops believes that the average age of customers who purchase a certain brand of top is 13 years of age. A sample of 31 customers had an average age of 14.1 years. At $\alpha = 0.05$, should his conjecture be rejected? The standard deviation of the ages is 1 year **(5 Marks)**

b) Giving examples in each case differentiate between the following:

i. Estimator and estimate **(2 Marks)**

ii. Point estimation and interval estimation **(2 Marks)**

iii. Confidence level and significant level **(2 Marks)**

c) The maize yield reported by a sample of 25 families randomly selected from the North Rift region is as below:

| Maize Yield | Number of Families |
|---|---|
| 2-4 | 5 |
| 4-6 | 6 |
| 6-8 | 11 |
| 8-10 | 3 |

Find the confidence interval for the population mean maize yield at 5% level of significance **(5 Marks)**

d) Ten applicants for British Council education programmes were interviewed for eventually obtaining a scholarship to take their master's programme in South Africa. Two panelists gave the ranking of the candidates as shown in the table below:

| Applicants | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Panelist 1 Ranks ($R_1$) | 1 | 2 | 7 | 9 | 8 | 6 | 4 | 3 | 10 | 5 |
| Panelist 2 Ranks ($R_2$) | 7 | 5 | 8 | 10 | 9 | 4 | 1 | 6 | 3 | 2 |

Calculate the Spearman's rank correlation between the two panelists **(4 Marks)**

e) A researcher estimates the following model for stock market returns.

$Y = 0.029 + 0.399X_1 - 0.112\ X_2$ with $R^2 = 0.67$

Interpret the values obtained for the constant, coefficients and $R^2$ **(4 Marks)**

f) Using well labeled diagrams explain any three characteristics of the shapes of the distribution of data **(6 Marks)**

## QUESTION TWO

a) Differentiate between one tailed test and two tailed tests **(4 Marks)**

b) Discuss any three probability methods of sampling **(3 Marks)**

c) The following data relate to advertising expenditures (in Sh. Millions) and their corresponding sales (in Sh. Millions)

| | | | | | |
|---|---|---|---|---|---|
| Advertising expenditure | 10 | 12 | 15 | 23 | 20 |
| Sales | 14 | 17 | 23 | 25 | 21 |

i. Estimate the sales corresponding to advertising expenditure of Sh. 300 million **(6 Marks)**

ii. Estimate the advertising expenditure for a sale target of sh. 35 million **(2 Marks)**

## QUESTION THREE

a) There are some missing values in the following ANOVA table. The data relate to three different types of mode of study.

| **Sources of variation** | **Sum of the Squares *(SS)*** | **Degree of Freedom, *df*** | **Mean Squares *(MS)*** | **Value of Statistical Test** |
|---|---|---|---|---|
| Between Samples | 40 | ___b=?_____ | ___d= ?_____ | F = ___f = ?___ |
| Within Samples | ____a=?_____ | _____c = ?___ | ____e = ?____ | |
| Total | 184 | 14 | | |

i) Complete the ANOVA table by filling in the missing values. **(6Marks)**

ii) Test the hypothesis that there is no difference between the means at 5 percent level of significance **(2 Marks)**

b) The mean yield of an acre plot is 800 Kgs with a standard deviation of 40Kg. Assuming that the distribution is normal, find the number of acres in a group of 200 plots that should be expected to yield

i. Over 850 Kg **(3 Marks)**

ii. Between 830 kg and 920 kg **(4 Marks)**

## QUESTION FOUR

a) The following data represent the amount of sugar consumed (in pounds) in a household during five randomly picked weeks: 3.8, 4.5, 5.2, 4.0 and 5.5. Construct a 90% confidence interval for the true mean consumption $\mu$. (Assume a normal distribution for the amount of sugar consumed) **(5 Marks)**

b) ABC company sells University text books within Nairobi CBD. They have made a decision to open outlets from various locations within the Country: in Kisumu, Mombasa, Turkana, Meru and Kisii. The sales manager has estimated that after one month the sales in each town would be 20 units. Data collected after one month indicated that sales were 21, 28, 24, 16 and 18 in Kisumu, Mombasa, Turkana, Meru and Kisii towns respectively. The company wished to determine whether there is significant difference between the expected sales and the sales which was recorded (actual sales). They have approached you as an expert:

i. Suggest the appropriate statistical tool which can be used for the analysis and give a reason for your choice **(3 Marks)**

ii. Identify three assumptions for the statistical tool suggested in (i) above **(3 Marks)**

c) Explain any four functions of statistics **(4 Marks)**

**FORMULAS**

Mean = $\frac{\sum X}{n}$

Mean, = $\frac{\Sigma FX}{\Sigma F}$

Z-Formula = $\frac{\text{Mean_Value}}{\text{standard deviation}}$

Mode = L + $\frac{F1}{F1+F2} \times i$ or Mode = $L+\left(\frac{D_1}{D_1+D_2}\right).c$

Median = L + $\frac{i}{F}$ (m – c) or Median = $L+\left(\frac{\frac{N}{2}-F_{m-1}}{f_m}\right).c$

$S^2 = \frac{\sum fx^2}{\sum f} - \bar{x}^2$ or $S^2 = \frac{\Sigma F(X-Mean)^2}{\Sigma F}$

$S = \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$ or $S = \sqrt{\frac{\Sigma F(X-mean)^2}{\Sigma F}}$ $CV = \frac{SD}{Mean} \times 100$

SKp= $3 \times \frac{(\text{mean - median})}{\text{Standard deviation}}$ $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $\bar{X}_{12} = \frac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1+N_2}$

$\delta_{12} = \sqrt{\frac{N_1\delta_1^2 + N_2\delta_2^2 + N_1d_1^2 + N_2d_2^2}{N_1+N_2}}$ $\mu = x_1p(x_1) + x_2p(x_2) + \ldots x_np(x_n) = \sum_{i=1}^{n} x_ip(x_i)$

$Var(X) = \sum_{i=1}^{n}(x_i-\mu)^2.p(x_i)$ $\bar{x} - z_{\alpha/2}\frac{\delta}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2}\frac{\delta}{\sqrt{n}}$

$\bar{x} - t_{n-1,\alpha/2}\frac{S}{\sqrt{n}} < \mu < \bar{x} + t_{n-1,\alpha/2}\frac{S}{\sqrt{n}}$ $Z = \frac{\bar{x}-\mu_0}{\delta/\sqrt{n}}$ $\chi^2 = \sum_{i=1}^{6}\frac{(O_i-E_i)^2}{E_i}$

$T = \frac{\bar{x}-\mu_0}{S/\sqrt{n}}$

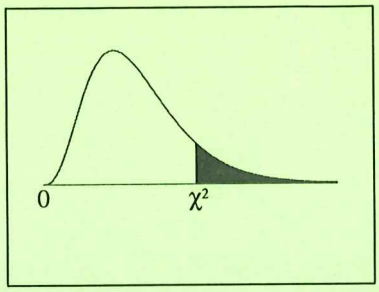
$$F = \frac{\text{MSB}}{\text{MSW}} \qquad \text{MSB} = \frac{\text{SSB}}{\text{k-1}} \qquad \text{MSW} = \frac{\text{SSW}}{n-k} \qquad \text{SSB} = \sum_{\text{j=1}}^{\text{k}} \frac{\text{T}_\text{j}^2}{\text{n}_\text{j}} - \frac{T^2}{N}$$

$$\text{SSW} = \sum_{j=1}^{k}\sum_{i=1}^{n_j} X_{ij}^2 - \sum_{j=1}^{k} \frac{T_j^2}{n_j} \qquad r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{\left[n\sum X^2 - \left(\sum X\right)^2\right]\left[n\sum Y^2 - \left(\sum Y\right)^2\right]}}$$

$$r = 1 - \frac{6\sum d^2}{n\left(n^2-1\right)} \qquad r\sqrt{\frac{n-2}{1-r^2}}. \qquad \hat{b} = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - \left(\sum X\right)^2}$$

$$\hat{a} = \frac{1}{n}\left(\sum Y - \hat{b}\sum X\right) \quad = \quad \bar{Y} - \hat{b}\bar{X}$$

# Chi-Square Distribution Table

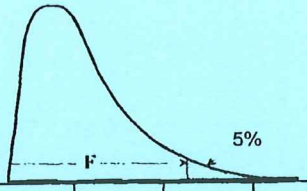



The shaded area is equal to $\alpha$ for $\chi^2 = \chi^2_\alpha$.

| *df* | $\chi^2_{.995}$ | $\chi^2_{.990}$ | $\chi^2_{.975}$ | $\chi^2_{.950}$ | $\chi^2_{.900}$ | $\chi^2_{.100}$ | $\chi^2_{.050}$ | $\chi^2_{.025}$ | $\chi^2_{.010}$ | $\chi^2_{.005}$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.000 | 0.000 | 0.001 | 0.004 | 0.016 | 2.706 | 3.841 | 5.024 | 6.635 | 7.879 |
| 2 | 0.010 | 0.020 | 0.051 | 0.103 | 0.211 | 4.605 | 5.991 | 7.378 | 9.210 | 10.597 |
| 3 | 0.072 | 0.115 | 0.216 | 0.352 | 0.584 | 6.251 | 7.815 | 9.348 | 11.345 | 12.838 |
| 4 | 0.207 | 0.297 | 0.484 | 0.711 | 1.064 | 7.779 | 9.488 | 11.143 | 13.277 | 14.860 |
| 5 | 0.412 | 0.554 | 0.831 | 1.145 | 1.610 | 9.236 | 11.070 | 12.833 | 15.086 | 16.750 |
| 6 | 0.676 | 0.872 | 1.237 | 1.635 | 2.204 | 10.645 | 12.592 | 14.449 | 16.812 | 18.548 |
| 7 | 0.989 | 1.239 | 1.690 | 2.167 | 2.833 | 12.017 | 14.067 | 16.013 | 18.475 | 20.278 |
| 8 | 1.344 | 1.646 | 2.180 | 2.733 | 3.490 | 13.362 | 15.507 | 17.535 | 20.090 | 21.955 |
| 9 | 1.735 | 2.088 | 2.700 | 3.325 | 4.168 | 14.684 | 16.919 | 19.023 | 21.666 | 23.589 |
| 10 | 2.156 | 2.558 | 3.247 | 3.940 | 4.865 | 15.987 | 18.307 | 20.483 | 23.209 | 25.188 |
| 11 | 2.603 | 3.053 | 3.816 | 4.575 | 5.578 | 17.275 | 19.675 | 21.920 | 24.725 | 26.757 |
| 12 | 3.074 | 3.571 | 4.404 | 5.226 | 6.304 | 18.549 | 21.026 | 23.337 | 26.217 | 28.300 |
| 13 | 3.565 | 4.107 | 5.009 | 5.892 | 7.042 | 19.812 | 22.362 | 24.736 | 27.688 | 29.819 |
| 14 | 4.075 | 4.660 | 5.629 | 6.571 | 7.790 | 21.064 | 23.685 | 26.119 | 29.141 | 31.319 |
| 15 | 4.601 | 5.229 | 6.262 | 7.261 | 8.547 | 22.307 | 24.996 | 27.488 | 30.578 | 32.801 |
| 16 | 5.142 | 5.812 | 6.908 | 7.962 | 9.312 | 23.542 | 26.296 | 28.845 | 32.000 | 34.267 |
| 17 | 5.697 | 6.408 | 7.564 | 8.672 | 10.085 | 24.769 | 27.587 | 30.191 | 33.409 | 35.718 |
| 18 | 6.265 | 7.015 | 8.231 | 9.390 | 10.865 | 25.989 | 28.869 | 31.526 | 34.805 | 37.156 |
| 19 | 6.844 | 7.633 | 8.907 | 10.117 | 11.651 | 27.204 | 30.144 | 32.852 | 36.191 | 38.582 |
| 20 | 7.434 | 8.260 | 9.591 | 10.851 | 12.443 | 28.412 | 31.410 | 34.170 | 37.566 | 39.997 |
| 21 | 8.034 | 8.897 | 10.283 | 11.591 | 13.240 | 29.615 | 32.671 | 35.479 | 38.932 | 41.401 |
| 22 | 8.643 | 9.542 | 10.982 | 12.338 | 14.041 | 30.813 | 33.924 | 36.781 | 40.289 | 42.796 |
| 23 | 9.260 | 10.196 | 11.689 | 13.091 | 14.848 | 32.007 | 35.172 | 38.076 | 41.638 | 44.181 |
| 24 | 9.886 | 10.856 | 12.401 | 13.848 | 15.659 | 33.196 | 36.415 | 39.364 | 42.980 | 45.559 |
| 25 | 10.520 | 11.524 | 13.120 | 14.611 | 16.473 | 34.382 | 37.652 | 40.646 | 44.314 | 46.928 |
| 26 | 11.160 | 12.198 | 13.844 | 15.379 | 17.292 | 35.563 | 38.885 | 41.923 | 45.642 | 48.290 |
| 27 | 11.808 | 12.879 | 14.573 | 16.151 | 18.114 | 36.741 | 40.113 | 43.195 | 46.963 | 49.645 |
| 28 | 12.461 | 13.565 | 15.308 | 16.928 | 18.939 | 37.916 | 41.337 | 44.461 | 48.278 | 50.993 |
| 29 | 13.121 | 14.256 | 16.047 | 17.708 | 19.768 | 39.087 | 42.557 | 45.722 | 49.588 | 52.336 |
| 30 | 13.787 | 14.953 | 16.791 | 18.493 | 20.599 | 40.256 | 43.773 | 46.979 | 50.892 | 53.672 |
| 40 | 20.707 | 22.164 | 24.433 | 26.509 | 29.051 | 51.805 | 55.758 | 59.342 | 63.691 | 66.766 |
| 50 | 27.991 | 29.707 | 32.357 | 34.764 | 37.689 | 63.167 | 67.505 | 71.420 | 76.154 | 79.490 |
| 60 | 35.534 | 37.485 | 40.482 | 43.188 | 46.459 | 74.397 | 79.082 | 83.298 | 88.379 | 91.952 |
| 70 | 43.275 | 45.442 | 48.758 | 51.739 | 55.329 | 85.527 | 90.531 | 95.023 | 100.425 | 104.215 |
| 80 | 51.172 | 53.540 | 57.153 | 60.391 | 64.278 | 96.578 | 101.879 | 106.629 | 112.329 | 116.321 |
| 90 | 59.196 | 61.754 | 65.647 | 69.126 | 73.291 | 107.565 | 113.145 | 118.136 | 124.116 | 128.299 |
| 100 | 67.328 | 70.065 | 74.222 | 77.929 | 82.358 | 118.498 | 124.342 | 129.561 | 135.807 | 140.169 |

# F-Table for 5%

**Percentage points of the F-distribution: upper 5% points**




| $df_{num}$ / $df_{den}$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 15 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 161.45 | 199.50 | 215.71 | 224.58 | 230.16 | 233.99 | 236.77 | 238.88 | 240.54 | 241.88 | 245.95 | 248.01 |
| 2 | 18.513 | 19.000 | 19.164 | 19.247 | 19.296 | 19.330 | 19.353 | 19.371 | 19.385 | 19.396 | 19.429 | 19.446 |
| 3 | 10.128 | 9.552 | 9.277 | 9.117 | 9.013 | 8.941 | 8.887 | 8.845 | 8.812 | 8.786 | 8.703 | 8.660 |
| 4 | 7.709 | 6.944 | 6.591 | 6.388 | 6.256 | 6.163 | 6.094 | 6.041 | 5.999 | 5.964 | 5.858 | 5.803 |
| 5 | 6.608 | 5.786 | 5.409 | 5.192 | 5.050 | 4.950 | 4.876 | 4.818 | 4.772 | 4.735 | 4.619 | 4.558 |
| 6 | 5.987 | 5.143 | 4.757 | 4.534 | 4.387 | 4.284 | 4.207 | 4.147 | 4.099 | 4.060 | 3.938 | 3.874 |
| 7 | 5.591 | 4.737 | 4.347 | 4.120 | 3.972 | 3.866 | 3.787 | 3.726 | 3.677 | 3.637 | 3.511 | 3.445 |
| 8 | 5.318 | 4.459 | 4.066 | 3.838 | 3.687 | 3.581 | 3.500 | 3.438 | 3.388 | 3.347 | 3.218 | 3.150 |
| 9 | 5.117 | 4.256 | 3.863 | 3.633 | 3.482 | 3.374 | 3.293 | 3.230 | 3.179 | 3.137 | 3.006 | 2.936 |
| 10 | 4.965 | 4.103 | 3.708 | 3.478 | 3.326 | 3.217 | 3.135 | 3.072 | 3.020 | 2.978 | 2.845 | 2.774 |
| 11 | 4.844 | 3.982 | 3.587 | 3.357 | 3.204 | 3.095 | 3.012 | 2.948 | 2.896 | 2.854 | 2.719 | 2.646 |
| 12 | 4.747 | 3.885 | 3.490 | 3.259 | 3.106 | 2.996 | 2.913 | 2.849 | 2.796 | 2.753 | 2.617 | 2.544 |
| 13 | 4.667 | 3.806 | 3.411 | 3.179 | 3.025 | 2.915 | 2.832 | 2.767 | 2.714 | 2.671 | 2.533 | 2.459 |
| 14 | 4.600 | 3.739 | 3.344 | 3.112 | 2.958 | 2.848 | 2.764 | 2.699 | 2.646 | 2.602 | 2.463 | 2.388 |
| 15 | 4.543 | 3.682 | 3.287 | 3.056 | 2.901 | 2.790 | 2.707 | 2.641 | 2.588 | 2.544 | 2.403 | 2.328 |
| 16 | 4.494 | 3.634 | 3.239 | 3.007 | 2.852 | 2.741 | 2.657 | 2.591 | 2.538 | 2.494 | 2.352 | 2.276 |
| 17 | 4.451 | 3.592 | 3.197 | 2.965 | 2.810 | 2.699 | 2.614 | 2.548 | 2.494 | 2.450 | 2.308 | 2.230 |
| 18 | 4.414 | 3.555 | 3.160 | 2.928 | 2.773 | 2.661 | 2.577 | 2.510 | 2.456 | 2.412 | 2.269 | 2.191 |
| 19 | 4.381 | 3.522 | 3.127 | 2.895 | 2.740 | 2.628 | 2.544 | 2.477 | 2.423 | 2.378 | 2.234 | 2.155 |
| 20 | 4.351 | 3.493 | 3.098 | 2.866 | 2.711 | 2.599 | 2.514 | 2.447 | 2.393 | 2.348 | 2.203 | 2.124 |
| 21 | 4.325 | 3.467 | 3.072 | 2.840 | 2.685 | 2.573 | 2.488 | 2.420 | 2.366 | 2.321 | 2.176 | 2.096 |
| 22 | 4.301 | 3.443 | 3.049 | 2.817 | 2.661 | 2.549 | 2.464 | 2.397 | 2.342 | 2.297 | 2.151 | 2.071 |
| 23 | 4.279 | 3.422 | 3.028 | 2.796 | 2.640 | 2.528 | 2.442 | 2.375 | 2.320 | 2.275 | 2.128 | 2.048 |
| 24 | 4.260 | 3.403 | 3.009 | 2.776 | 2.621 | 2.508 | 2.423 | 2.355 | 2.300 | 2.255 | 2.108 | 2.027 |
| 25 | 4.242 | 3.385 | 2.991 | 2.759 | 2.603 | 2.490 | 2.405 | 2.337 | 2.282 | 2.236 | 2.089 | 2.007 |
| 26 | 4.225 | 3.369 | 2.975 | 2.743 | 2.587 | 2.474 | 2.388 | 2.321 | 2.265 | 2.220 | 2.072 | 1.990 |
| 27 | 4.210 | 3.354 | 2.960 | 2.728 | 2.572 | 2.459 | 2.373 | 2.305 | 2.250 | 2.204 | 2.056 | 1.974 |
| 28 | 4.196 | 3.340 | 2.947 | 2.714 | 2.558 | 2.445 | 2.359 | 2.291 | 2.236 | 2.190 | 2.041 | 1.959 |
| 29 | 4.183 | 3.328 | 2.934 | 2.701 | 2.545 | 2.432 | 2.346 | 2.278 | 2.223 | 2.177 | 2.027 | 1.945 |
| 30 | 4.171 | 3.316 | 2.922 | 2.690 | 2.534 | 2.421 | 2.334 | 2.266 | 2.211 | 2.165 | 2.015 | 1.932 |
| 40 | 4.085 | 3.232 | 2.839 | 2.606 | 2.449 | 2.336 | 2.249 | 2.180 | 2.124 | 2.077 | 1.924 | 1.839 |
| 60 | 4.001 | 3.150 | 2.758 | 2.525 | 2.368 | 2.254 | 2.167 | 2.097 | 2.040 | 1.993 | 1.836 | 1.748 |
| 120 | 3.920 | 3.072 | 2.680 | 2.447 | 2.290 | 2.175 | 2.087 | 2.016 | 1.959 | 1.910 | 1.750 | 1.659 |
| 100K | 3.842 | 2.996 | 2.605 | 2.372 | 2.214 | 2.099 | 2.010 | 1.939 | 1.880 | 1.831 | 1.666 | 1.571 |

K (Multiply this value by 1000)