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QUALIFICATION : BACHELOR of SCIENCE IN APPLIED MATHEMATICS AND STATISTICS	
QUALIFICATION CODE: 07BSAM	LEVEL: 6
COURSE: APPLIED MATHEMATICAL AND STATISTICAL COMPUTING	COURSE CODE: AMS602S
DATE: NOVEMBER 2024	SESSION: 1
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY: QUESTION PAPER

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MODERATOR: *Mr. S. Kashihalwa*

INSTRUCTIONS:

1. Answer all the questions using MATLAB R2007b and IBM SPSS Statistics 29 software on your computer into the z-drive
2. Create a MS Word document in your z-drive on your computer. Copy your results from MATLAB R2007b and IBM SPSS Statistics 29 in the MS Word document and save the MS Word file containing your student number, e.g. 2001349.
3. No books, notes and other additional aids are allowed.
4. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS:

1. Computer with MATLAB R2007b, IBM SPSS Statistics 28 and MS Office software

ATTACHEMENTS

1. None

This paper consists of 8 pages including this front page

Use **MATLAB R2007b**, installed in your computer, to answer the following questions.

QUESTION 1 [25 MARKS]

1.1. Let $A = \begin{pmatrix} 6 & 4 & 3 \\ 7 & 3 & 4 \\ 9 & 6 & 5 \end{pmatrix}$

1.1.1. Using the column operator (:), create a column vector that contains all the columns of A. [2]

1.1.2. Using the column operator (:), create a column vector that contains all the rows of A. [2]

1.1.3. Using the column operator (:), create a row vector that contains the 1st row and the 3rd column of A. [2]

1.2. Let $X = [1 \ 4 \ 5 \ -1 \ 0 \ 7]$

1.2.1 Extract the entries 1, 3 and 5 of X [2]

1.2.2 Square the entries 2, 4 and 6 of X [2]

1.2.3 Create the scalar Y that contains the third entry of X [2]

1.3. Draw the curve [6]

$$f(x, y) = -\left(\frac{x}{5}\right)^2 - \left(\frac{y}{5}\right)^2 - 16$$

for $-5 \leq x \leq 5$ and $-5 \leq y \leq 5$. Using the surf function. Label axis and provide a title. Remove the grid. Color the curve in gray.

1.4. Solve the following system of linear equations. [5]

$$2x - 3y + 4z = 5$$

$$y + 4z + x = 10$$

$$-2z + 3x + 4y = 0$$

1.5. Write the MATLAB command for the following line and solve for Y.

$$Y = |Xe^{aX} - \cos(bX)| \text{ for } a = 11, b = \pi \text{ and } X = \{2, 4, 6, 8\}$$

[2]

QUESTION 2 [25 MARKS]

2.1. Type the following data in a notepad file, save the file as a text file and name it as **drive.txt**. Load the file in MATLAB. Save the text file in your folder in the z-drive.

[6]

Drive A	Drive B	Drive C
11	11	9
7	13	11
14	17	20
11	13	9
43	51	69
38	46	76
61	132	186
75	135	180
38	88	115
28	36	55
12	12	14
18	27	30
18	19	29
17	15	18
19	36	48
32	47	10
42	65	92
57	66	151
44	55	90
114	145	257
35	58	68
11	12	15
13	9	15
10	9	7

2.1.1. Find the mean, median and mode of the data set. [3]

2.1.2. Compute the range, variance and standard deviation of the data set [3]

2.1.3. Create a 2 dimensional scatter plot of Drive A and Drive B with labels Drive A and Drive B. [3]

2.1.4. Find the covariance of Drive A and Drive B, the correlation coefficient (r) and the correlation of determination (r^2). [6]

2.1.5. Use the data from Drive A and display the shape of the data in the form of a histogram and its exponential fit. [4]

QUESTION 3 [30 MARKS]

3.1 Project Hope Namibia (PHN) hired 3 unemployed youth to do in-home care for elderly people at the Senior Park in Pioneers Park, Windhoek so that the elderly can remain independent and stay in their homes as long as possible. The students do cleaning, yard work, shopping, etc. The PHN employed 5 students from NUST to interview the seniors in their homes and assessing their need for services. The information is used to match the seniors with the students who want employment:

The following variables were used to collect data about the elderly people:

- Age at last birthday ("age"):
- Sex of respondent ("sex"):
 - 1 = Male
 - 2 = Female
- Lives alone ("alone"):
 - 1=Yes
 - 2=No
- Low income ("lowincome"):
 - 1 = Eligible for Supplemental Security Income,
 - 2 = Not Eligible for Supplemental Security Income
- Need for assistance with the activities of daily living ("ADL"):
 - 1 = Bathing
 - 2 = Dressing
 - 3 = Toileting

4 = Transferring in/out of bed

5 = Eating

- Total number of ADLs needing help: Need for assistance with the instrumental activities of daily living ("IADL"):

1=Using telephone

2=Shopping

3=Preparing food

4=Light housework

5=Heavy housework

6=Finances

- Systolic Blood Pressure ("SBP")

To keep track of the needs of potential clients, the program created a data file from one month's new applications shown in Table 1 below.

Table 1: Senior park residents

pn	age	sex	alone	lowincome	ADL	IADL	SBP
1	74	2	2	2	2	4	215
2	66	1	2	2	4	6	144
3	81	2	1	2	2	5	200
4	76	2	2	2	3	4	180
5	74	1	1	2	1	5	175
6	69	2	2	1	4	4	152
7	79	2	1	2	2	4	170
8	80	1	2	1	3	6	171
9	89	2	2	2	3	5	220
10	60	1	1	2	2	6	154
11	88	2	1	2	3	3	218
12	82	2	1	2	2	4	211
13	79	2	1	2	1	4	177
14	77	1	2	2	3	6	175
15	62	1	1	2	1	4	128
16	83	1	2	2	4	6	130
17	80	2	1	2	2	2	188
18	85	1	2	2	1	4	125
19	66	1	1	2	1	3	116
20	84	1	2	2	4	6	155
21	74	2	2	2	4	4	136
22	64	1	2	2	1	2	142
23	74	1	1	2	2	5	120
24	63	1	2	2	3	6	120
25	66	2	2	2	2	6	160
26	63	1	1	1	1	3	158
27	60	1	1	2	3	6	125
28	65	2	2	1	2	2	155
29	61	1	1	2	4	4	144
30	69	1	1	2	3	6	175

3.1.1 Enter the data from Table 1 above into SPSS and define all the variables in SPSS. Save your SPSS data file in your z-drive using your initials and student number, eg. **Studentno_Q3**. [10]

3.1.2. Recode the variable “age” into “agegroup” using the following categories:

1 = 60-69 yrs

2 = 70-79 yrs

3 = 80+ yrs

Define the variable with labels and run a frequency table of the variable “agegroup”. [2]

3.1.3. Produce frequency tables with counts and percent and appropriate graphs of the following variables:

- i. Sex of respondent (“sex”)
- ii. Lives alone (“alone”)
- iii. Need for assistance with the activities of daily living (“ADL”)
- iv. Need for assistance with the instrumental activities of daily living (“IADL”) [8]

3.1.4. Produce descriptive statistics and a histogram with a normal curve of the following variables:

- i. Age at last birthday (“age”)
- ii. Systolic Blood Pressure (“SBP”) [4]

3.1.5. MoHSS would like to determine whether there is an association between the Sex of respondent (“sex”) and whether the respondent lives alone (“alone”). State the null and alternative hypothesis. Run an appropriate test to test the hypothesis. Write up a short narrative explaining your results. [6]

Question 4 (25 marks)

Please use the data from Question 3.1 to answer the following questions:

4.1 What is the mean age and mean SBP of the 30 people? [2]

4.2 Carry out a simple linear regression of SBP as the dependent variable and age as the independent variable and show the results. [4]

4.3 State the regression equation and interpret the equation in terms of age and systolic blood pressure. [4]

4.4 How much of the variation in systolic blood pressure is explained by the differences in age? [2]

4.5 Is the regression line significant? State your hypothesis and the p-value? [3]

4.6 If women have, on the average, lower systolic blood pressure than men, can we conclude that this is also true in our population? Can we make an inference about the population (all people) from our sample of 30 people selected from the population? Is the difference statistically significant? State the p-value. [5]

4.7 Use One-Way Analysis of Variance to compare the mean age of females and males? [5]

*****END OF EXAMINATION*****