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QUALIFICATION : BACHELOR OF AGRICULTURAL MANAGEMENT, BACHELOR OF HORTICULTURE	
QUALIFICATION CODE: **07BAGR, 07BHOR**	LEVEL: **5**
COURSE: **AGRICULTURAL STATISTICS**	COURSE CODE: **AGS520S**
DATE: **JANUARY 2025**	SESSION: **1**
DURATION: **3 HOURS**	MARKS: **100**

SECOND OPPORTUNITY / SUPPLEMENTARY: EXAMINATION QUESTION PAPER

EXAMINER: *Mr Jonas Amunyela, Mr Polykarp Amukuhu*

MODERATOR: *Mr Andrew Roux*

INSTRUCTIONS:

1. Answer all questions on the separate answer sheet.
2. Please write neatly and legibly.
3. Do not use the left side margin of the exam paper. This must be allowed for the examiner.
4. No books, notes and other additional aids are allowed.
5. Mark all answers clearly with their respective question numbers.

PERMISSIBLE MATERIALS:

1. Non-Programmable Calculator

ATTACHEMENTS

1. Z Table
2. T distribution table
3. Chi-square table
4. Formula sheet

This paper consists of 7 pages including this front page

SECTION A

QUESTION 1 **[20 marks]**

Write down the letter corresponding to your choice next to the question number.

1.1 A random sample of size $n = 10$ was selected from a population and the data are as follows: 290,300, 450, 230, 501, 802 ,609, 102 ,710 ,605. Use this dataset to answer questions 1.1.1 and 1.1.2

1.1.1 The point estimate for the mean is [2]

A. 459.9
B. 214.5
C. 46003.49
D. 45.47
E. 47.45

1.1.2 The standard deviation is equal to [2]

A. 220.09
B. 51.11
C. 226.09
D. 22.29
E. 6.81

1.2 What is the standard error of the dataset above [2]

A. 70.00
B. 59.50
C. 71.50
D. 11.45
E 0.00

1.3 Which of the following hypothesis test can be used in statistics when $n = 29\ and\ \sigma = 29$? [2]

A. T-test
B. Z-test
C. one-way ANOVA
D. Kruskal-Wallis test
E. chi-square test

1.4 A researcher conducted a survey to determine the average amount of money household spend on buying diesel for their vehicles during a week. They found the distribution of amounts spent per week to follow a normal distribution with a population standard deviation of \$125. A random of sample of 45 diesel users revealed that $\bar{x} = N\$550$. Determine the 95% confidence interval for μ: [2]

A. (18.60; 21;40)

B. (19.37; 20.63)

C. (200; 100.40)

D. (513.48; 586.52)

E. (180.6; 210.40)

1.5 The sampling technique whereby members of the population are placed in an array and every tenth member is selected is an example of: [2]

A. Random sampling

B. Systematic sampling

C. Cluster sampling

D. Stratified sampling

E. None

1.6 If a variable X represent the number of seeds germinated per season, then X is a________ random variable [2]

A. continuous

B. descriptive

C. discrete

D. normal

E. none

1.7 A new vaccine introduced for foot & mouth disease will either cure it or not, this is a possible application of; [2]

A. Poisson distribution

B. Normal distribution

C. Binomial distribution

D Z-distribution

E. none

1.8 In a Poisson distribution the mean (μ) for a random variable X is the same as;

[2]

A. Variance (σ^2)

B. Standard deviation (σ)

C. Number of success

D. Number of occurrences

E. none

1.9 The mean intelligence of high school boys is known to be 100 within a standard deviation of 16. A random sample of 36 is drawn from this population and showed a mean of 96. What is the probability that the mean of this sample will be more than 96? [2]

A. 0.0668

B. -1.5

C. 0.9332

D. 0.2340

E. 0.9332

SECTION B (Clearly show all your work)

Question 2 **(39 marks)**

2.1 In 2019, three hundred deaths of live stocks related to drought were recorded daily in Omusati region. The table below display the grouped data for three hundred livestock that died because of drought just within 40 days.

Days	0-5	5-10	10-15	15-20	20-25	25-30	30-35
Number of cows	2	0	8	36	110	78	66

2.1.1 Find the mean, median and the mode of the distribution. [10]

2.1.2 Find the variance and the standard deviation for the dataset. [5]

2.1.3 Suppose that you suspected an outlier in the dataset above, which measure of central location would you prefer to describe the data and why? [2]

2.2 Let X be a discrete random variable with the following probability distribution.

X	5	10	15	20	22	25
$P(x)$	0.05	0.3	0.25	0.20	y	0.15

2.2.1 Determine the value of y [2]

2.2.2 Find the mean and standard deviation of X. [5]

2.2.3 Find the mean and variance of 2X. [4]

2.2.4 Find $P(X \leq 10)$ [2]

2.3 In a large restaurant an average of 3 out of every 5 customers ask for water with their meal. A random sample of 10 customers is selected. Find the probability that

2.3.1 exactly 6 ask for water with their meal [3]

2.3.2 At most 9 ask for water with their meal [4]

2.3.3 At least 8 ask for water with their meal [2]

Question 3 **(30 marks)**

3.1 The operation Manager wants to have 99% confidence in estimating the proportion of non-conforming equipment to within ± 0.05 of its true value. No information is available from past data. Determine the sample size needed [4]

3.2 In a certain cattle-raising region of the country, it had become a practice among some farmers to feed their Breed X cows a protein supplement which, when fed to other dairy breeds, had never been known to do anything except increase milk yields. The monthly milk yields of a random sample of 50 protein-supplemented cows were recorded. The mean value $\bar{x}$ was 209 litres and the population standard deviation was 40 litres. Is there any reason to believe that the protein supplement has increased the milk yield of Breed X cows by more than 200 litres? $\alpha = 5\%$

3.2.1 State the hypothesis that you would use to test the company's claim [2]

3.2.2 Formulate the decision rule and find the critical value [4]

3.2.3 Calculate the test statistics [3]

3.2.4 What is your decision and conclusion regarding the above hypothesis [3]

3.3 Suppose that two groups of chickens of the same breed have been reared on two different diets-high protein and low protein. After a period, the chickens are weighed, and the following results are obtained (units g).

High protein	264	306	410	376	372	436
Low protein	252	420	392	308	308	299

3.3.1 Determine if the diets had different effects on the growth of chickens.
Use, $\alpha = 0.02$ [8]

3.3.2 Construct a 95% confidence interval for the mean difference of the two diets [6]

Question 4 **(11 marks)**

4.1 The following data shows the value of exports of fish and fish products in millions of Namibian dollars (NAD) for a local company.

Years	2019	2020	2021	2022	2023	2024
shipments	510.30	542.14	547.50	563.25	567.10	570.12

4.1.1 Estimate the variance of the entire shipments with a 99% degree of confidence [7]

4.1.2 If it is assumed that the variance of all the shipments is more N$ 550 [4]

Formulate the null and alternative hypothesis that you would use to test the assumption and calculate the test statistics.

************************END OF QUESTION PAPER***************************

FORMULA SHEET

$M_e = L + \frac{c[0.5n - CF]}{f_{me}}$	$M_0 = L + \frac{c[f_m - f_{m-1}]}{2f_m - f_{m-1} - f_{m+1}}$
$\bar{x} = \frac{\sum fx}{n}$	$Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$
$\bar{x} \pm Z_{\frac{\alpha}{2}}(\frac{\sigma}{\sqrt{n}})$	$(p_1 - p_2) \pm Z_{\frac{\alpha}{2}}(\sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}})$
$t_{stat} = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$	$\frac{(n-1)S^2}{\chi^2_{\frac{\alpha}{2}, n-1}} < \sigma^2 < \frac{(n-1)S^2}{\chi^2_{1-\frac{\alpha}{2}, n-1}}$
$\chi^2_{stat} = \frac{(n-1)S^2}{\sigma^2}$	$\chi^2_{stat} = \sum \frac{(f_0 - f_e)^2}{f_e}$
$E(X) = \sum x_i p_i$	$V(X) = \sum (x_i - \mu)^2 p(x_i)$
$P(X = x) = \binom{n}{x} p^x q^{n-x}$	$n = \frac{Z^2(\sigma^2)}{E^2}$
$b = \frac{n \sum xy - \sum x \sum y}{n \sum x^2 - (\sum x)^2}$	$a = \bar{y} - b\bar{x}$
$\bar{\pi} = \frac{x_1 + x_2}{n_1 + n_2}$	$Z_{cal} = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\bar{\pi}(1 - \bar{\pi})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$
$\bar{x} = \frac{\sum x}{n}$	$s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$
$n = \frac{z^2 p(1-p)}{E^2}$	$s^2 = \frac{\sum (x_i - \bar{x})^2 f_i}{n-1}$
$p \pm z\sqrt{\frac{pq}{n}}$	$\bar{x} \pm t_{\frac{\alpha}{2}, n-1}(\frac{s}{\sqrt{n}})$
$Z = \frac{x - \mu}{\sigma}$	$(\bar{x}_A - \bar{x}_B) \pm t\sqrt{\frac{s_A^2}{n_A} + \frac{s_B^2}{n_B}}$
$P(X = k) = \frac{e^{-\theta}\theta^x}{x!}$	$n = \frac{z^2 p(1-p)}{E^2}$

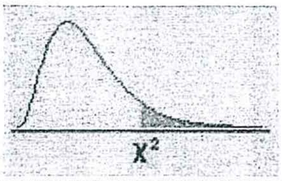
Z - Table

The table shows cumulative probabilities for the standard normal curve.

Cumulative probabilities for NEGATIVE z-values are shown first. SCROLL DOWN to the 2nd page for POSITIVE z

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
-3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
-3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
-3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
-3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
-2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
-2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
-2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
-2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
-2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
-2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
-2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
-2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
-2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
-2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
-1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
-1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
-1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
-1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
-1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
-1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
-1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
-1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
-1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
-1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
-0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
-0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
-0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
-0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
-0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
-0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
-0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
-0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
-0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

APPENDIX E: The Chi-Square Distribution



df\p	.995	.990	.975	.950	.900	.750	.500	.250	.100	.050	.025	.010	.005
1	0.00004	0.00016	0.00098	0.00393	0.01579	0.10153	0.45494	1.32330	2.70554	3.84146	5.02389	6.63490	7.87944
2	0.01003	0.02010	0.05064	0.10259	0.21072	0.57536	1.38629	2.77259	4.60517	5.99146	7.37776	9.21034	10.59663
3	0.07172	0.11483	0.21580	0.35185	0.58437	1.21253	2.36597	4.10834	6.25139	7.81473	9.34840	11.34487	12.83816
4	0.20699	0.29711	0.48442	0.71072	1.06362	1.92256	3.35669	5.38527	7.77944	9.48773	11.14329	13.27670	14.86026
5	0.41174	0.55430	0.83121	1.14548	1.61031	2.67460	4.35146	6.62568	9.23636	11.07050	12.83250	15.08627	16.74960
6	0.67573	0.87209	1.23734	1.63538	2.20413	3.45460	5.34812	7.84080	10.64464	12.59159	14.44938	16.81189	18.54758
7	0.98926	1.23904	1.68987	2.16735	2.83311	4.25485	6.34581	9.03715	12.01704	14.06714	16.01276	18.47531	20.27774
8	1.34441	1.64650	2.17973	2.73264	3.48954	5.07064	7.34412	10.21885	13.36157	15.50731	17.53455	20.09024	21.95495
9	1.73493	2.08790	2.70039	3.32511	4.16816	5.89883	8.34283	11.38875	14.68366	16.91898	19.02277	21.66599	23.58935
10	2.15586	2.55821	3.24697	3.94030	4.86518	6.73720	9.34182	12.54886	15.98718	18.30704	20.48318	23.20925	25.18818
11	2.60322	3.05348	3.81575	4.57481	5.57778	7.58414	10.34100	13.70069	17.27501	19.67514	21.92005	24.72497	26.75685
12	3.07382	3.57057	4.40379	5.22603	6.30380	8.43842	11.34032	14.84540	18.54935	21.02607	23.33666	26.21697	28.29952
13	3.56503	4.10692	5.00875	5.89186	7.04150	9.29907	12.33976	15.98391	19.81193	22.36203	24.73560	27.68825	29.81947
14	4.07467	4.66043	5.62873	6.57063	7.78953	10.16531	13.33927	17.11693	21.06414	23.68479	26.11895	29.14124	31.31935
15	4.60092	5.22935	6.26214	7.26094	8.54676	11.03654	14.33886	18.24509	22.30713	24.99579	27.48839	30.57791	32.80132
16	5.14221	5.81221	6.90766	7.96165	9.31224	11.91222	15.33850	19.36886	23.54183	26.29623	28.84535	31.99993	34.26719
17	5.69722	6.40776	7.56419	8.67176	10.08519	12.79193	16.33818	20.48868	24.76904	27.58711	30.19101	33.40866	35.71847
18	6.26480	7.01491	8.23075	9.39046	10.86494	13.67529	17.33790	21.60489	25.98942	28.86930	31.52638	34.80531	37.15645
19	6.84397	7.63273	8.90652	10.11701	11.65091	14.56200	18.33765	22.71781	27.20357	30.14353	32.85233	36.19087	38.58226
20	7.43384	8.26040	9.59078	10.85081	12.44261	15.45177	19.33743	23.82769	28.41198	31.41043	34.16961	37.56623	39.99685
21	8.03365	8.89720	10.28290	11.59131	13.23960	16.34438	20.33723	24.93478	29.61509	32.67057	35.47888	38.93217	41.40106
22	8.64272	9.54249	10.98232	12.33801	14.04149	17.23962	21.33704	26.03927	30.81328	33.92444	36.78071	40.28936	42.79565
23	9.26042	10.19572	11.68855	13.09051	14.84796	18.13730	22.33688	27.14134	32.00690	35.17246	38.07563	41.63840	44.18128
24	9.88623	10.85636	12.40115	13.84843	15.65868	19.03725	23.33673	28.24115	33.19624	36.41503	39.36408	42.97982	45.55851
25	10.51965	11.52398	13.11972	14.61141	16.47341	19.93934	24.33659	29.33885	34.38159	37.65248	40.64647	44.31410	46.92789
26	11.16024	12.19815	13.84390	15.37916	17.29188	20.84343	25.33646	30.43457	35.56317	38.88514	41.92317	45.64168	48.28988
27	11.80759	12.87850	14.57338	16.15140	18.11390	21.74940	26.33634	31.52841	36.74122	40.11327	43.19451	46.96294	49.64492
28	12.46134	13.56471	15.30786	16.92788	18.93924	22.65716	27.33623	32.62049	37.91592	41.33714	44.46079	48.27824	50.99338
29	13.12115	14.25645	16.04707	17.70837	19.76774	23.56659	28.33613	33.71091	39.08747	42.55697	45.72229	49.58788	52.33562
30	13.78672	14.95346	16.79077	18.49266	20.59923	24.47761	29.33603	34.79974	40.25602	43.77297	46.97924	50.89218	53.67196