NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: BACHELOR OF AGRICULTURAL MANAGEMENT	
QUALIFICATION CODE: 07BAGR	**LEVEL:** 5
COURSE CODE: AGS520S	**COURSE NAME:** STATISTICS FOR AGRICULTURE
SESSION: JANUARY 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

SECOND OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINER(S)	MR. J Amunyela
MODERATOR:	MR.A.Roux
INSTRUCTIONS	
1. Answer ALL the questions. 2. Write clearly and neatly. 3. Number the answers clearly.	
ATTACHMENT: formula sheet, t-table, z-table, chi-square table	

PERMISSIBLE MATERIALS

1. Non-Programmable Calculator without the cover

THIS QUESTION PAPER CONSISTS OF 7 PAGES (Including this front)

SECTION A

QUESTION 1 [22 marks]

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

1.1 A random sample of size $n = 11$ was selected from a population and the data are as follows: 29,30, 45, 23, 51, 82 ,69, 12 ,71 ,65, 39. 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. 50.5

B. 12

C. 46.91

D. 45.47

E. 47.45

1.1.2 The standard error of the sample mean is equal to [2]

A. 50.3

B. 6.72

C. 71.6

D. 22.29

E. 6.81

1.2 What is the range of the dataset above [2]

A. 70

B. 59

C. 40

D. 11

E 0

1.3 Which of the following hypothesis test can be used in statistics when $n = 34\ and\ \sigma = 29$? [2]

A. T-test

B. Z-test

C. one-way ANOVA

D. Kruskal-Wallis test

E. chi-square test

1.4 A research firm conducted a survey to determine the mean amount of money steady smokers spend on cigarettes during a week. They found the distribution of amounts spent per week followed a normal distribution with a standard deviation of N$5. A random sample of 49 steady smokers revealed that $\bar{x} = N\$20$. Determine the 95% confidence interval for μ: [3]

A. (18.60; 21;40)

B. (19.37; 20.63)
C. (20; 1.40)
D. (19.83; 20.17)
E. (18.6; 21.40)

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 less than 96? [3]

A. 0.0668

B. -1.5

C. 0.9332

D. 0.2340

E. none

SECTION B (Clearly show all your work)

Question 2 (39 marks)

2.1 In 2017, three hundred deaths of cows related to drought were recorded daily in Omusati region. The table below display the grouped data for three hundred cows that died as a result 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		25
P(x)	0.05	0.3	0.25	0.25		0.15

2.2.1 Find the mean and standard deviation of X. [6]

2.2.2 Find the mean and standard deviation of 2X. [4]

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

2.3 During the summer months (June to August, inclusive) an average 5 marriages per month take place in a small city. Assuming marriages occur randomly and independently, find the probability of the following

2.3.1 Fewer than 3 marriages take place in a given summer month [4]

2.3.2 At least 3 marriages will take place in the whole summer period [4]

2.3.3 Exactly 10 marriages will take place in the two months of July and August. [2]

Question 3 (29 marks)

3.1 The operation Manager wants to have 90% confidence in estimating the proportion of non-conforming newspapers to within ± 0.05 of its true value. No information is available from past data. Determine the sample size needed [3]

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 of time, the chickens are weighed, and the following results are obtained (units g).

High protein	364	336	420	476	392	476
Low protein	252	420	392	308	308	

3.3.1 The purpose of the experiment was to find out if the diets had different effects on the growth of chickens. Test at $\alpha = 0.02$ [8]

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

Question 4 (11 marks)

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

Years	2012	2013	2014	2015	2016	2017
shipments	510.30	542.14	547.50	563.25	567.10	570.12

4.1.1 construct the simple linear regression equation using the method of least square (t=1,2,3...) [9]

4.1.2 Estimate the value of fish export for the year 2018 [2]

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

FORMULA SHEET

$M_e = L + \frac{c[0.5n - CF]}{f_{me}}$

$M_0 = L + \frac{c[f_m - f_{m-1}]}{2f_m - f_{m-1} - f_{m+1}}$

$\bar{x} = \frac{\sum fx}{n}$

$Z = \frac{\bar{x}-\mu}{\frac{\sigma}{\sqrt{n}}}$

$\bar{x} \pm Z_{\frac{\alpha}{2}}(\frac{\sigma}{\sqrt{n}})$

$(p_1 - p_2) \pm Z_{\frac{\alpha}{2}}(\sqrt{\frac{p_1 q_1}{n_1} + \frac{p_2 q_2}{n_2}})$

$t_{stat} = \frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}$

$\frac{(n-1)S^2}{\chi^2_{\frac{\alpha}{2},n-1}} < \sigma^2 < \frac{(n-1)S^2}{\chi^2_{1-\frac{\alpha}{2},n-1}}$

$\chi^2_{stat} = \frac{(n-1)S^2}{\sigma^2}$

$\chi^2_{stat} = \sum \frac{(f_0 - f_e)^2}{f_e}$

$E(X) = \sum x_i p_i$

$V(X) = \sum (x_i - \mu)^2 p(x_i)$

$P(X = x) = \binom{n}{x} p^x q^{n-x}$

$n = \frac{Z^2(\sigma^2)}{E^2}$

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

$a = \bar{y} - b\bar{x}$

$Z_{cal} = \frac{(p_1 - p_2) - (\pi_1 - \pi_2)}{\sqrt{\hat{\pi}(1-\hat{\pi})\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$

$\hat{\pi} = \frac{x_1 + x_2}{n_1 + n_2}$

$\bar{x} = \frac{\sum x}{n}$

$s^2 = \frac{\sum (x_i - \bar{x})^2}{n-1}$

$n = \frac{z^2 p(1-p)}{E^2}$

$s^2 = \frac{\sum (x_i - \bar{x})^2 f_i}{n-1}$

$p \pm z\sqrt{\frac{pq}{n}}$

$\bar{x} \pm t_{\frac{\alpha}{2},n-1}(\frac{s}{\sqrt{n}})$

$Z = \frac{x-\mu}{\sigma}$

$(\bar{x}_A - \bar{x}_B) \pm t\sqrt{\frac{s_A^2}{n_A} + \frac{s_B^2}{n_B}}$

$P(X = k) = \frac{e^{-\theta}\theta^x}{x!}$

$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \bar{\mu}_2)}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$

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

Cumulative probabilities for POSITIVE z-values are shown below.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

TABLE of CRITICAL VALUES for STUDENT'S t DISTRIBUTIONS

Column headings denote probabilities (α) above tabulated values.

d.f.	**0.40**	**0.25**	**0.10**	**0.05**	**0.04**	**0.025**	**0.02**	**0.01**	**0.005**	**0.0025**	**0.001**	**0.0005**
1	0.325	1.000	3.078	6.314	7.916	12.706	15.894	31.821	63.656	127.321	318.289	636.578
2	0.289	0.816	1.886	2.920	3.320	4.303	4.849	6.965	9.925	14.089	22.328	31.600
3	0.277	0.765	1.638	2.353	2.605	3.182	3.482	4.541	5.841	7.453	10.214	12.924
4	0.271	0.741	1.533	2.132	2.333	2.776	2.999	3.747	4.604	5.598	7.173	8.610
5	0.267	0.727	1.476	2.015	2.191	2.571	2.757	3.365	4.032	4.773	5.894	6.869
6	0.265	0.718	1.440	1.943	2.104	2.447	2.612	3.143	3.707	4.317	5.208	5.959
7	0.263	0.711	1.415	1.895	2.046	2.365	2.517	2.998	3.499	4.029	4.785	5.408
8	0.262	0.706	1.397	1.860	2.004	2.306	2.449	2.896	3.355	3.833	4.501	5.041
9	0.261	0.703	1.383	1.833	1.973	2.262	2.398	2.821	3.250	3.690	4.297	4.781
10	0.260	0.700	1.372	1.812	1.948	2.228	2.359	2.764	3.169	3.581	4.144	4.587
11	0.260	0.697	1.363	1.796	1.928	2.201	2.328	2.718	3.106	3.497	4.025	4.437
12	0.259	0.695	1.356	1.782	1.912	2.179	2.303	2.681	3.055	3.428	3.930	4.318
13	0.259	0.694	1.350	1.771	1.899	2.160	2.282	2.650	3.012	3.372	3.852	4.221
14	0.258	0.692	1.345	1.761	1.887	2.145	2.264	2.624	2.977	3.326	3.787	4.140
15	0.258	0.691	1.341	1.753	1.878	2.131	2.249	2.602	2.947	3.286	3.733	4.073
16	0.258	0.690	1.337	1.746	1.869	2.120	2.235	2.583	2.921	3.252	3.686	4.015
17	0.257	0.689	1.333	1.740	1.862	2.110	2.224	2.567	2.898	3.222	3.646	3.965
18	0.257	0.688	1.330	1.734	1.855	2.101	2.214	2.552	2.878	3.197	3.610	3.922
19	0.257	0.688	1.328	1.729	1.850	2.093	2.205	2.539	2.861	3.174	3.579	3.883
20	0.257	0.687	1.325	1.725	1.844	2.086	2.197	2.528	2.845	3.153	3.552	3.850
21	0.257	0.686	1.323	1.721	1.840	2.080	2.189	2.518	2.831	3.135	3.527	3.819
22	0.256	0.686	1.321	1.717	1.835	2.074	2.183	2.508	2.819	3.119	3.505	3.792
23	0.256	0.685	1.319	1.714	1.832	2.069	2.177	2.500	2.807	3.104	3.485	3.768
24	0.256	0.685	1.318	1.711	1.828	2.064	2.172	2.492	2.797	3.091	3.467	3.745
25	0.256	0.684	1.316	1.708	1.825	2.060	2.167	2.485	2.787	3.078	3.450	3.725
26	0.256	0.684	1.315	1.706	1.822	2.056	2.162	2.479	2.779	3.067	3.435	3.707
27	0.256	0.684	1.314	1.703	1.819	2.052	2.158	2.473	2.771	3.057	3.421	3.689
28	0.256	0.683	1.313	1.701	1.817	2.048	2.154	2.467	2.763	3.047	3.408	3.674
29	0.256	0.683	1.311	1.699	1.814	2.045	2.150	2.462	2.756	3.038	3.396	3.660
30	0.256	0.683	1.310	1.697	1.812	2.042	2.147	2.457	2.750	3.030	3.385	3.646
31	0.256	0.682	1.309	1.696	1.810	2.040	2.144	2.453	2.744	3.022	3.375	3.633
32	0.255	0.682	1.309	1.694	1.808	2.037	2.141	2.449	2.738	3.015	3.365	3.622
33	0.255	0.682	1.308	1.692	1.806	2.035	2.138	2.445	2.733	3.008	3.356	3.611
34	0.255	0.682	1.307	1.691	1.805	2.032	2.136	2.441	2.728	3.002	3.348	3.601
35	0.255	0.682	1.306	1.690	1.803	2.030	2.133	2.438	2.724	2.996	3.340	3.591
36	0.255	0.681	1.306	1.688	1.802	2.028	2.131	2.434	2.719	2.990	3.333	3.582
37	0.255	0.681	1.305	1.687	1.800	2.026	2.129	2.431	2.715	2.985	3.326	3.574
38	0.255	0.681	1.304	1.686	1.799	2.024	2.127	2.429	2.712	2.980	3.319	3.566
39	0.255	0.681	1.304	1.685	1.798	2.023	2.125	2.426	2.708	2.976	3.313	3.558
40	0.255	0.681	1.303	1.684	1.796	2.021	2.123	2.423	2.704	2.971	3.307	3.551
60	0.254	0.679	1.296	1.671	1.781	2.000	2.099	2.390	2.660	2.915	3.232	3.460
80	0.254	0.678	1.292	1.664	1.773	1.990	2.088	2.374	2.639	2.887	3.195	3.416
100	0.254	0.677	1.290	1.660	1.769	1.984	2.081	2.364	2.626	2.871	3.174	3.390
120	0.254	0.677	1.289	1.658	1.766	1.980	2.076	2.358	2.617	2.860	3.160	3.373
140	0.254	0.676	1.288	1.656	1.763	1.977	2.073	2.353	2.611	2.852	3.149	3.361
160	0.254	0.676	1.287	1.654	1.762	1.975	2.071	2.350	2.607	2.847	3.142	3.352
180	0.254	0.676	1.286	1.653	1.761	1.973	2.069	2.347	2.603	2.842	3.136	3.345
200	0.254	0.676	1.286	1.653	1.760	1.972	2.067	2.345	2.601	2.838	3.131	3.340
250	0.254	0.675	1.285	1.651	1.758	1.969	2.065	2.341	2.596	2.832	3.123	3.330
inf	0.253	0.674	1.282	1.645	1.751	1.960	2.054	2.326	2.576	2.807	3.090	3.290