FIJI NATIONAL UNIVERSITY

COLLEGE OF AGRICULTURE, FISHERIES & FORESTRY
SCHOOL OF AGRICULTURAL SCIENCE
DEPARTMENT OF AGRICULTURAL ECONOMICS AND EXTENSION EDUCATION

Trade Diploma in Agriculture - Year II

AGS 501: AGRICULTURAL STATISTICS

FINAL EXAMINATION – TRIMESTER 3, 2016

Time Allowed: 3 hours plus 10 minutes reading
Total marks: 100

INSTRUCTIONS

1. This paper consists of **three** sections and **10** pages.
2. Answer all questions in the answer booklet provided.
3. Make sure to indicate your **identification number** in all pages you use.
4. You can use permitted calculators.
5. Statistical Tables are attached with list of formulae.
6. This exam is worth 50% of your overall mark.

SECTION A	20 MULTIPLE CHOICE QUESTIONS	20 MARKS
SECTION B	PART I: 10 TRUE/FALSE QUESTIONS PART II: 10 FILL IN THE BLANKS	10 MARKS 10 MARKS
SECTION C	5 LONG ANSWER QUESTIONS	60 MARKS

SECTION A: MULTIPLE CHOICE (20 MARKS)

This section consists of 20 multiple choice questions worth 1 mark each. Write the letter corresponding to the best answer in the Answer Booklet provided.

1. The 'number of tomatoes AGS501 students have picked during their practical classes' is an example of which type of variable?

   (A) a discrete variable
   (B) a continuous variable
   (C) a qualitative variable
   (D) none of the above

2. If you classified a quality of fruit as "Excellent", "Good", "Satisfactory" and "Poor", this would be an example of which level of measurement?

   (A) Nominal (B) Ordinal (C) Ratio (D) Interval

3. Which of the following is **not** a basic method to obtain samples?

   (A) stratified
   (B) cluster
   (C) random
   (D) irregular

4. A Statistics Lecturer at FNU is interested in the mean number of days an AGS501 student is absent from tutorial classes. She takes her sample by gathering data on 15 randomly selected students from AGS501 unit. The type of sampling she used is:

   (A) Cluster sampling
   (B) Stratified sampling
   (C) Simple Random sampling
   (D) Systematic sampling

5. What are the boundaries of 20 - 25 ounces?

   (A) 19.5 – 25.5 ounces
   (B) 19.45 - 25.45 ounces
   (C) 19.55 - 25.55 ounces
   (D) 21 - 26 ounces

6. What is another name for ogive?

   (A) Histogram
   (B) Frequency Polygon
   (C) Cumulative Frequency Graph
   (D) Stem and Leaf Plot

7. Except for rounding errors, relative frequencies should add up to what sum?

   (A) 0 (B) 1 (C) 50 (D) 100

8. Which is the best measure of central tendency with outliers in the data set?

   (A) Mean (B) Median (C) Mode (D) Range

9. What is the value of the mode when all values in the data set are different?

(A) 0
(B) 1
(C) There is no mode.
(D) It cannot be determined unless the data values are given.

10. Suppose we have measured and recorded the heights of all bean plants in Koronivia Farm. In statistical terminology, the 'variable' is

(A) all bean plants
(B) data collected
(C) height
(D) data value

11. The advantage of stem and leaf plots over grouped frequency distribution is that it

(A) is more reliable.
(B) can be used when there are lots of data values.
(C) is a more systematic way to organize data.
(D) can retain the actual data while showing them in graphical form.

12. Let X be the number of days per week that 30 AGS501 students do a 30 minute work on the Koronivia Farm.

X	Number of Students
0	3
1	2
2	3
3	8
4	1
5	9
6	4

The mean is:
(A) 5 (B) 8 (C) 3.5 (D) 4

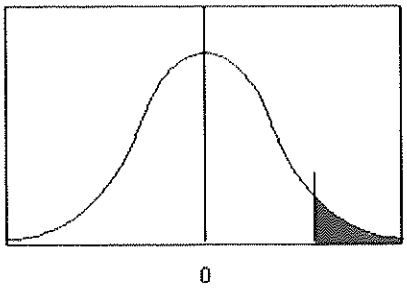
13. If the mode is to the left of the median and the mean is to the right of the median, then the distribution is:

(A) Right skewed
(B) Left skewed
(C) Symmetrical
(D) Uniformed

14. When the value of α is increased, the probability of committing a type I error is

(A) Decreased (B) Increased (C) The same (D) None of the above

15. Which type of alternative hypothesis is used in the figure below?



(A) $H_1: \mu = k$ (B) $H_1: \mu \neq k$ (C) $H_1: \mu > k$ (D) $H_1: \mu < k$

16. If you wish to test the claim that the mean of the population is 100, the appropriate null hypothesis is

(A) $\bar{X} = 100$
(B) $\mu \leq 100$
(C) $\mu \geq 100$
(D) $\mu \neq 100$

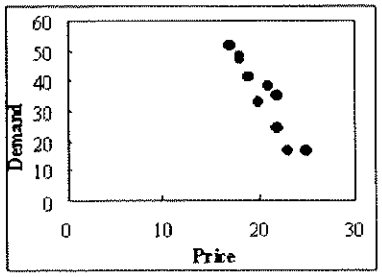
17. For the t-test, one uses _____ instead of σ.

(A) n (B) s (C) μ (D) $\bar{X}$

18. In regression, the variable being predicted is usually referred to as the

(A) dependent variable
(B) independent variable
(C) coefficient of correlation
(D) coefficient of determination

19. The following scatter plot indicates



(A) strong positive correlation
(B) no correlation
(C) positive correlation
(D) negative correlation

20. The coefficient of determination is in the range of

(A) $0 < r^2 < 1$
(B) $-1 < r^2 < 1$
(C) $0 \leq r^2 \leq 1$
(D) $-1 \leq r^2 \leq 1$

SECTION B: **(20 MARKS)**

Part I: **True/False Questions** **(10 marks)**

In the Answer Booklet provided write true or false for the following questions.

1. The variable temperature is an example of a quantitative variable.
2. It is not important to keep the width of each class the same in a frequency distribution.
3. In construction of a frequency polygon, the class limits are used for the x-axis.
4. When the mean is computed for individual data, all values in the data set are used.
5. An outlier affects the median more than the mean.
6. The positive square root of the variance is called standard deviation.
7. No error is committed when the null hypothesis is rejected when it is false.
8. The test value separates the rejection region from the nonrejection region.
9. A correlation coefficient of +1 implies a strong positive linear relationship between the variables.
10. A negative relationship between two variables means that for the most part, as the x variable increases, the y variable increases.

Part II: **Fill in the Blanks** **(10 marks)**

Fill in the blanks with (word or phrase or symbol or letter) the appropriate answer in the Answer Booklet.

1. A group of plants selected from the group of all plants under study is called a _____.
2. The three types of frequency distributions are _____, Ungrouped and Grouped.
3. Picking every 10^{th} bean plant from a large plot for study would be an example of _____ sampling.
4. Two major branches of statistics are Descriptive and _____.
5. A measure obtained from sample data is called a sample _____.
6. The symbol for population standard deviation is _____.

7. An extremely high or extremely low data value is called an _____.
8. To test the claim that the mean is greater than 87, you would use a _____-tailed test.

9. The range of '*r*' is from _____ to _____.

10. The regression line is also called the _____.

SECTION C: LONG ANSWER QUESTIONS (60 MARKS)

This section consists of 5 long answer questions worth 12 marks each. Write your answers in the Answer Booklet provided. Show all necessary working as partial marks will be awarded to partially correct answers.

QUESTION 1 ***Start on a new page*** **[4+4+3+1 = 12 marks]**

A sample of 30 plant heights (in centimeters) was taken by Agricultural Statistics students. Here are the results:

6	9	14	15	16	17	18	21	23	24
24	27	28	33	36	37	39	39	40	40
41	43	44	45	47	48	53	57	59	63

(i) Construct a frequency distribution for these data using 5 classes.
(ii) Draw a histogram and a frequency polygon using relative frequencies on the same pair of axes.
(iii) Draw a cumulative relative frequency graph.
(iv) What is the shape of the distribution?

QUESTION 2 ***Start on a new page*** **[2+2+1+2+2+2+1= 12 marks]**

The following table gives the grouped frequency distribution of the number of mangoes picked by 50 farmers.

No. of mangoes	40-70	70-100	100-130	130-160	160-190
Farmers	9	11	16	10	4

Calculate the following:

(i) Mean
(ii) Median
(iii) Mode
(iv) Variance
(v) Standard Deviation
(vi) Coefficient of Variation
(vii) Skewness

QUESTION 3 *Start on a new page* **[(1+2+1+1+4)+3= 12 marks]**

The result on the grain yield of paddy (kg/plot) under the ammonium chloride treatment is given below:

13.4 10.9 11.2 11.8 14.0 15.3 14.2 12.6 17.0 16.2

A. Calculate the following:
(i) Range
(ii) Median, Q_2.
(iii) Lower quartile, Q_1.
(iv) Upper quartile, Q_3.
(v) Mean Deviation.

B. Draw a stem and leaf plot for the data above.

QUESTION 4 *Start on a new page* **[6+6 = 12 marks]**

A. From a field of Co.33 paddy, a sample of 36 plants was selected at random. From these plants the panicle lengths were observed. The mean and standard deviation of these measurements were 18.7cm, and 1.25cm, respectively. Test at 5% level of significance whether the mean length of panicle of Co.33 paddy is 19cm.

B. Ten plants are chosen from a population at random whose heights in inches are given below:

52 55 57 61 64 65 67 68 70 71

At $\alpha = 0.1$, test the claim that the mean heights of plants is greater than 60 inches.

QUESTION 5 *Start on a new page* **[4+3+3+2 = 12 marks]**

An Agricultural Statistics student for a survey recorded the seed yield per plant (in grams) *(y)* and plant height (in centimeters) *(x)* of bean as shown in the following table:

Seed yield per plant (in g), y	5.22	8.13	6.52	4.16	8.98	3.05	3.49	5.40	2.39	2.71	3.97	7.56
Plant height (in cm), x	94.2	69.3	115.3	83.3	85.4	68.1	50.7	96.2	76.1	52.0	82.1	81.3

(i) Compute the value of the correlation coefficient and interpret.
(ii) Find the coefficient of determination and interpret what it means.
(iii)Determine the regression line equation
(iv)Predict seed yield per plant, y, when the plant height, x, is 100cm.

THE END

LIST OF FORMULAE:

1. Sample mean, $\overline{X} = \frac{\sum f.X_m}{n}$

2. Sample variance, $S^2 = \frac{\sum f(X_m - \overline{X})^2}{n-1}$

3. $MD = l + \frac{N/_2 - m}{f} \times c$

4. Correlation coefficient, $r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{n(\sum x^2) - (\sum x)^2} \cdot \sqrt{n(\sum y^2) - (\sum y)^2}}$

5. The regression line $y' = a + bx$, where

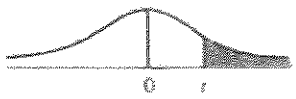
$$a = \frac{(\sum y)(\sum x^2) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2}; \quad b = \frac{n(\sum xy) - (\sum x)(\sum y)}{n(\sum x^2) - (\sum x)^2}$$

6. $z = \frac{\bar{X} - \mu}{\sigma/\sqrt{n}}$

7. $t = \frac{\bar{X} - \mu}{s/\sqrt{n}}$

TABLE 1: The t-Distribution Table

The entries in this table give the critical values of t for the specified number of degrees of freedom and areas in the right tail.



	Area in the Right Tail under the t Distribution Curve					
df	.10	.05	.025	.01	.005	.001
1	3.078	6.314	12.706	31.821	63.657	318.309
2	1.886	2.920	4.303	6.965	9.925	22.327
3	1.638	2.353	3.182	4.541	5.841	10.215
4	1.533	2.132	2.776	3.747	4.604	7.173
5	1.476	2.015	2.571	3.365	4.032	5.893
6	1.440	1.943	2.447	3.143	3.707	5.208
7	1.415	1.895	2.365	2.998	3.499	4.785
8	1.397	1.860	2.306	2.896	3.355	4.501
9	1.383	1.833	2.262	2.821	3.250	4.297
10	1.372	1.812	2.228	2.764	3.169	4.144
11	1.363	1.796	2.201	2.718	3.106	4.025
12	1.356	1.782	2.179	2.681	3.055	3.930
13	1.350	1.771	2.160	2.650	3.012	3.852
14	1.345	1.761	2.145	2.624	2.977	3.787
15	1.341	1.753	2.131	2.602	2.947	3.733
16	1.337	1.746	2.120	2.583	2.921	3.686
17	1.333	1.740	2.110	2.567	2.898	3.646
18	1.330	1.734	2.101	2.552	2.878	3.610
19	1.328	1.729	2.093	2.539	2.861	3.579
20	1.325	1.725	2.086	2.528	2.845	3.552
21	1.323	1.721	2.080	2.518	2.831	3.527
22	1.321	1.717	2.074	2.508	2.819	3.505
23	1.319	1.714	2.069	2.500	2.807	3.485
24	1.318	1.711	2.064	2.492	2.797	3.467
25	1.316	1.708	2.060	2.485	2.787	3.450
26	1.315	1.706	2.056	2.479	2.779	3.435
27	1.314	1.703	2.052	2.473	2.771	3.421
28	1.313	1.701	2.048	2.467	2.763	3.408
29	1.311	1.699	2.045	2.462	2.756	3.396
30	1.310	1.697	2.042	2.457	2.750	3.385
31	1.309	1.696	2.040	2.453	2.744	3.375
32	1.309	1.694	2.037	2.449	2.738	3.365
33	1.308	1.692	2.035	2.445	2.733	3.356
34	1.307	1.691	2.032	2.441	2.728	3.348
35	1.306	1.690	2.030	2.438	2.724	3.340

TABLE 2: Areas under Standard Normal Probability Curve (Source: Eton Table)

z	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359	4	8	12	16	20	24	28	32	36
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754	4	8	12	16	20	24	28	32	36
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141	4	8	12	15	19	22	27	31	35
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517	4	8	11	15	19	22	26	30	34
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879	4	7	11	14	18	22	25	29	32
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224	3	7	10	14	17	21	24	27	31
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549	3	6	10	13	16	19	23	26	29
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852	3	6	9	12	15	18	21	24	27
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133	3	6	8	11	14	17	19	22	25
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389	3	5	8	10	13	15	18	20	23
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621	2	5	7	9	12	14	16	18	21
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830	2	4	6	8	10	12	14	16	19
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015	2	4	5	7	9	11	13	15	16
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177	2	3	5	6	8	10	11	13	14
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319	1	3	4	6	7	8	10	11	13
1.5	.4337	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441	1	2	4	5	6	7	8	10	11
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545	1	2	3	4	5	6	7	8	9
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633	1	2	3	3	4	5	6	7	8
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706	1	1	2	3	4	4	5	6	6
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767	1	1	2	2	3	4	4	5	5
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817	0	1	1	2	2	3	3	4	4
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857	0	1	1	2	2	2	3	3	4
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890	0	1	1	1	2	2	2	3	3
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916	0	0	1	1	1	2	2	2	2
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936	0	0	1	1	1	1	1	2	2
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952	0	0	0	1	1	1	1	1	1
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964	0	0	0	0	1	1	1	1	1
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974	0	0	0	0	0	1	1	1	1
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981	0	0	0	0	0	0	0	0	1
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986	0	0	0	0	0	0	0	0	1
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990	0	0	0	0	0	0	0	0	0
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993	0	0	0	0	0	0	0	0	0
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995	0	0	0	0	0	0	0	0	0
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4995	.4996	.4996	.4997	0	0	0	0	0	0	0	0	0
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998	0	0	0	0	0	0	0	0	0
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	0	0	0	0	0	0	0	0	0
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	0	0	0	0	0	0	0	0	0
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	0	0	0	0	0	0	0	0	0
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	0	0	0	0	0	0	0	0	0
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	0	0	0	0	0	0	0	0	0