CENTRAL UNIVERSITY

END OF SECOND SEMESTER EXAMINATION: 2016/2017

FACULTY OF ARTS AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

ECON 204 (3 CREDITS)

INTERMEDIATE STATISTICS

LEVEL 200

8TH JUNE, 2017.

2 HOURS

STUDENT ID No.....

INSTRUCTIONS

ANSWER **ALL** QUESTIONS IN SECTION A and **TWO (2)** QUESTIONS IN SECTION B.
(Note that question number 1 in section B is compulsory)

(You may use your calculator and the provided copy of the textbook formula card)

DO NOT TURN OVER THIS PAGE UNTIL YOU HAVE BEEN TOLD TO DO SO BY THE INVIGILATOR

LECTURER: Daniel Offei

SECTION A (60 Marks)
Answer ***ALL*** the Questions

1. You take a random sample from some population and form a 96% confidence interval for the population mean, μ. Which quantity is guaranteed to be in the interval you form?
   a) 0
   b) μ
   c) $\bar{x}$
   d) 0.96

2. Suppose you conduct a significance test for the population proportion and your p-value is 0.184. Given a 0.10 level of significance, which of the following should be your conclusion?
   a) accept H_O
   b) accept H_A
   c) Fail to reject H_A
   d) Fail to reject H_O

   χ 7.5% we reject

3. Decreasing the sample size, while holding the confidence level the same, will do what to the length of your confidence interval?
   a) make it bigger
   b) make it smaller
   c) it will stay the same
   d) cannot be determined from the given information

4. Decreasing the confidence level, while holding the sample size the same, will do what to the length of your confidence interval?
   a) make it bigger
   b) make it smaller
   c) it will stay the same
   d) cannot be determined from the given information

5. If you increase the sample size and confidence level at the same time, what will happen to the length of your confidence interval?
   a) make it bigger
   b) make it smaller
   c) it will stay the same
   d) cannot be determined from the given information

6. Suppose that we wanted to estimate the true average number of eggs a queen bee lays with 95% confidence. The margin of error we are willing to accept is 0.5. Suppose we also know that standard deviation (s) is about 10.What sample size should we use?
   a) 1536
   b) 1537
   c) 2653
   d) 2650

7. What should be the value of z used in a 93% confidence interval?
   a) 2.70
   b) 1.40
   c) 1.81
   d) 1.89

8. "What are the possible values of x-bar for all samples of a given n from this population?" To answer this question, we would need to look at the:
   a) test statistic
   b) z-scores of several statistics
   c) standard normal distribution
   d) sampling distribution

9. Why do we use inferential statistics?
   a) to help explain the outcomes of random phenomena
   b) to make informed predictions about parameters we don't know
   c) to describe samples that are normal and large enough (n>30)
   d) to generate samples of random data for a more reliable analysis

Questions 10-13 Researchers are concerned about the impact of students working while they are enrolled in classes, and they'd like to know if students work too much and therefore are spending less time on their classes than they should be. First, the researchers need to find out, on average, how many hours a week students are working. They know from previous studies that the standard deviation of this variable is about 5 hours.

10. A survey of 200 students provides a sample mean of 7.10 hours worked. What is a 95% confidence interval based on this sample?
    a) (6.10, 8.10)
    b) (6.41, 7.79)
    c) (6.57, 7.63)
    d) (7.10, 8.48)

11. Suppose that this confidence interval was (6.82, 7.38). Which of these is a valid interpretation of this confidence interval?
    a) There is a 95% probability that the true average number of hours worked by all UF students is between 6.82 and 7.38 hours.
    b) There is a 95% probability that a randomly selected student worked between 6.82 and 7.38 hours.
    c) We are 95% confident that the average number of hours worked by students in our sample is between 6.82 and 7.38 hours.
    d) We are 95% confident that the average number of hours worked by all UF students is between 6.82 and 7.38 hours.

12. We have 95% confidence in our interval, instead of 100%, because we need to account for the fact that:
    a) the sample may not be truly random.
    b) we have a sample, and not the whole population.
    c) the distribution of hours worked may be skewed
    d) all of the above

13. The researchers are not satisfied with their confidence interval and want to do another study to find a shorter confidence interval. What should they change to ensure they find a shorter confidence interval?
    a. They should increase their confidence level and increase their sample size.
    b. They should increase their confidence level but decrease their sample size.
    c. They should decrease their confidence level but increase their sample size.
    d. They should decrease their confidence level and decrease their sample size.

Questions 14-15: Suppose we are interested in finding a 95% confidence interval for the mean SAT Verbal score of students at a certain high school. Five students are sampled, and their SAT Verbal scores are 560, 500, 470, 660, and 640.

14. What is the standard error of the sample mean?
    a. 16.71
    b. 37.36
    c. 83.55
    d. 113.2

15. What is the 95% confidence interval for the population mean?
    a. (462.3, 669.7)
    b. (469.9, 662.1)
    c. (486.3, 645.7)
    d. (492.8, 639.2)

16. A survey of 100 fatal accidents showed that in 32 cases the driver at fault was inadequately insured. Find a point estimate for p, the population proportion of accidents where the driver at fault was inadequately insured.
    a) 0.32
    b) 0.68
    c) 0.471
    d) 0.242

17. The principal at Riverside High School would like to estimate the mean length of time each day that it takes all the buses to arrive and unload the students. How large a sample is needed if the principal would like to assert with 99% confidence that the sample mean is off by, at most, 6 minutes. Assume $\sigma = 10$ minutes.
    a) 20
    b) 18
    c) 19
    d) 21

18. If the level of significance is 0.05, and the P-value is 0.043, the decision would be to
    a) fail to reject H0.
    b) make no decision because the difference between the level of significance and the critical value
    c) P-value is not statistically significant.
    d) reject H0.

19. A Type I error is committed when,
    a) a correct null hypothesis is accepted.
    b) an incorrect null hypothesis is rejected.
    c) an incorrect null hypothesis is accepted.
    d) a correct null hypothesis is rejected.

20. The dividing point between the region where the null hypothesis is rejected and the region where it is not rejected is known as,
    a) Test statistic
    b) Level of significance
    c) Critical value
    d) Confidence level

SECTION B

*Answer **QUESTION 1** and **any other** Question*

QUESTION 1 (Compulsory)

A). The Pro-Vice Chancellor (Academics) at Central University is wondering if foreign students are different from the general student body in terms of academic achievement. They gather a random sample of 200 foreign students and learn from the registrar that the mean GPA for all students is 2, but the standard deviation of the population has never been computed. They find that the mean GPA of foreign students is 2.58 with standard deviation (s) equals 1.23
Is the GPA of foreign students significantly higher than the mean of the population of all students? Set $\alpha = .05$ and use the ***p-value*** method to draw your conclusions.

Null Hypothesis:

Alternative Hypothesis:

Test Statistic:

Conclusion about the Null Hypothesis:

Conclusion addressing the original claim:

(20 Marks)

QUESTION 2

A reputable Bankneeds information concerning the savings account balances of its customers. A random sample of fifteen (15) accounts was checked. The mean balance was Ghs700 with a standard deviation of Ghs 150. Find a 98% confidence interval for the true mean. Assume that the account balances are normally distributed. Report your confidence intervals rounded to the nearest pesewa.

Find the appropriate critical value for $t_{\frac{\alpha}{2}}$ or $Z_{\frac{\alpha}{2}}$ and report it: _____

Compute the margin of error (show your work):

Report the confidence interval:

(20 Marks)

QUESTION 3

The Dean of Faculty of Arts and Social Sciences at Central University, Prof. Clara Fayorsey, is interested in determining the proportion of students who receive some sort of financial aid. Rather than examine the records for all students, the dean randomly selects 200 students and finds that 82 of them are NOT receiving financial aid. Use a 99% confidence interval to estimate the true proportion of students on financial aid.

Find the appropriate critical value for $t_{\frac{\alpha}{2}}$ or $Z_{\frac{\alpha}{2}}$ and report it: 2.575 .

Compute the margin of error (show your work): 0.0895

Report the confidence interval: $0.3205 \leq u \leq 0.4995$

(20 marks)

$x = 82$

$n = 200$

0.99

$p = \frac{x}{n}$

$m \cdot \varepsilon = Z_{\frac{\alpha}{2}} \sqrt{\frac{p(1-p)}{n}}$

$C \cdot I = p - Z_{\frac{\alpha}{2}} \sqrt{\frac{p(1-p)}{n}} \leq u \leq p + Z_{\frac{\alpha}{2}} \sqrt{\frac{p(1-p)}{n}}$

0.005

0.0895

FORMULAR CARD AND STATISTICAL TABLES

Ch. 8: Statistics (one population)

$$z = \frac{\hat{p} - p}{\sqrt{\frac{pq}{n}}}$$ Proportion—one population

$$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}}$$ Mean—one population (σ known)

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$ Mean—one population (σ unknown)

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2}$$ Standard deviation or variance—one population

Ch. 7: Confidence intervals (one population)

$\hat{p} - E < p < \hat{p} + E$ Proportion

where $E = z_{\alpha/2}\sqrt{\frac{\hat{p}\hat{q}}{n}}$

$\bar{x} - E < \mu < \bar{x} + E$ Mean

where $E = z_{\alpha/2}\frac{\sigma}{\sqrt{n}}$ (σ known)

or $E = t_{\alpha/2}\frac{s}{\sqrt{n}}$ (σ unknown)

$$\frac{(n-1)s^2}{\chi^2_R} < \sigma^2 < \frac{(n-1)s^2}{\chi^2_L}$$ Variance

Ch. 7: Simple Size Determination

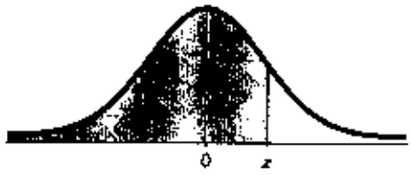
$$n = \frac{[z_{\alpha/2}]^2 \cdot 0.25}{E^2}$$ Proportion

$$n = \frac{[z_{\alpha/2}]^2 \hat{p}\hat{q}}{E^2}$$ Proportion ($\hat{p}$ and $\hat{q}$ are known)

$$n = \left[\frac{z_{\alpha/2}\sigma}{E}\right]^2$$ Mean

SAMPLE VARIANCE

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



POSITIVE *z* Scores

TABLE A-2 (continued) Cumulative Area from the LEFT

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

$2.5 + \frac{0.07 + 0.08}{2}$

TABLE E.3

Critical Values of t

For a particular number of degrees of freedom, entry represents the critical value of t corresponding to the cumulative probability $(1 - \alpha)$ and a specified upper-tail area (α).

Degrees of Freedom	Cumulative Probabilities					
				0.975		
	Upper-Tail Areas					
			0.25		0.05	0.025
1	1.0000	3.0777	6.3138	12.7062	31.8207	63.6574
2	0.8165	1.8856	2.9200	4.3027	6.9646	9.9248
3	0.7649	1.6377	2.3534	3.1824	4.5407	5.8409
4	0.7407	1.5332	2.1318	2.7764	3.7469	4.6041
5	0.7267	1.4759	2.0150	2.5706	3.3649	4.0322
6	0.7176	1.4398	1.9432	2.4469	3.1427	3.7074
7	0.7111	1.4149	1.8946	2.3646	2.9980	3.4995
8	0.7064	1.3968	1.8595	2.3060	2.8965	3.3554
9	0.7027	1.3830	1.8331	2.2622	2.8214	3.2498
10	0.6998	1.3722	1.8125	2.2281	2.7638	3.1693
11	0.6974	1.3634	1.7959	2.2010	2.7181	3.1058
12	0.6955	1.3562	1.7823	2.1788	2.6810	3.0545
13	0.6938	1.3502	1.7709	2.1604	2.6503	3.0123
14	0.6924	1.3450	1.7613	2.1448	2.6245	2.9768
15	0.6912	1.3406	1.7531	2.1315	2.6025	2.9467
16	0.6901	1.3368	1.7459	2.1199	2.5835	2.9208
17	0.6892	1.3334	1.7396	2.1098	2.5669	2.8982
18	0.6884	1.3304	1.7341	2.1009	2.5524	2.8784
19	0.6876	1.3277	1.7291	2.0930	2.5395	2.8609
20	0.6870	1.3253	1.7247	2.0860	2.5280	2.8453