國立成功大學 104 學年度碩士班招生考試試題

系所組別：經濟學系

考試科目：統計學

考試日期：0211，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Please read the instruction carefully before answering the questions:

The exam consists of 50 multiple-choice questions. All questions are equally weighted and there is a single best answer for each question (which means the numerically closest answer if the answer is a number and the answer you obtained is not given). The exam is worth 100 points. Please number the question you are answering; otherwise, no points will be given.

Multiple Choice Questions (100 points, 2 points each)

Identify ONE best answer for each question.

1. The ___ can be used to show the rank order and shape of a data set simultaneously.
   A) ogive
   B) pie chart
   C) stem-and-leaf display
   D) bar chart

2. The measure of location which is the most likely to be influenced by extreme values in the data set is the
   A) range
   B) median
   C) mode
   D) mean

3. The hourly wages of a sample of 130 system analysts are given below.

   mean = 60 range = 20
   mode = 73 variance = 324
   median = 74

   The coefficient of variation equals
   A) 0.30%
   B) 30%
   C) 5.4%
   D) 54%

4. If the variance of a data set is correctly computed with the formula using $n - 1$ in the denominator, which of the following is true?
   A) the data set is a sample
   B) the data set is a population
   C) the data set could be either a sample or a population
   D) the data set is from a census

5. The measure of dispersion that is influenced most by extreme values is
   A) the variance
   B) the standard deviation
   C) the range
   D) the interquartile range

（背面仍有題目，請繼續作答）

國立成功大學 104 學年度碩士班招生考試試題

系所組別：經濟學系

考試科目：統計學

考試日期：0211，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

6. The sum of deviations of the individual data elements from their mean is
   A) always greater than zero
   B) always less than zero
   C) sometimes greater than and sometimes less than zero, depending on the data elements
   D) always equal to zero

7. The measure of dispersion which is not measured in the same units as the original data is the
   A) median
   B) standard deviation
   C) coefficient of determination
   D) variance

8. During a cold winter, the temperature stayed below zero for ten days (ranging from -20 to -5). The variance of the temperatures of the ten-day period
   A) is negative since all the numbers are negative
   B) must be at least zero
   C) cannot be computed since all the numbers are negative
   D) can be either negative or positive

9. Since the mode is the most frequently occurring data value, it
   A) can never be larger than the mean
   B) is always larger than the median
   C) is always larger than the mean
   D) None of these alternatives is correct.

10. On a December day, the probability of snow is .30. The probability of a "cold" day is .50. The probability of snow and "cold" weather is .15. Are snow and "cold" weather independent events?
    A) only if given that it snowed
    B) no
    C) yes
    D) only when they are also mutually exclusive

11. A perfectly balanced coin is tossed 6 times, and tails appears on all six tosses. Then, on the seventh trial
    A) tails cannot appear
    B) heads has a larger chance of appearing than tails
    C) tails has a better chance of appearing than heads
    D) None of these alternatives is correct.

12. The expected value of a random variable is
    A) the value of the random variable that should be observed on the next repeat of the experiment
    B) the value of the random variable that occurs most frequently
    C) the square root of the variance
    D) None of these alternatives is correct.

國立成功大學 104 學年度碩士班招生考試試題

系所組別：經濟學系

考試科目：統計學

考試日期：0211，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

[Student Body] The student body of a large university consists of 60% female students. A random sample of 8 students is selected. Use this information for Questions 13 and 14.

13. **[Student Body]** What is the probability that among the students in the sample exactly two are female?
    A) 0.0896
    B) 0.2936
    C) 0.0413
    D) 0.0007

14. **[Student Body]** What is the probability that among the students in the sample at least 7 are female?
    A) 0.1064
    B) 0.0896
    C) 0.0168
    D) 0.8936

15. Larger values of the standard deviation result in a normal curve that is
    A) shifted to the right
    B) shifted to the left
    C) narrower and more peaked
    D) wider and flatter

16. The purpose of statistical inference is to provide information about the
    A) sample based upon information contained in the population
    B) population based upon information contained in the sample
    C) population based upon information contained in the population
    D) mean of the sample based upon the mean of the population

17. In developing an interval estimate, if the population standard deviation is unknown
    A) it is impossible to develop an interval estimate
    B) the standard deviation is arrived at using the range
    C) the sample standard deviation can be used
    D) it is assumed that the population standard deviation is 1

18. A sample of 20 items from a population with an unknown σ is selected in order to develop an interval estimate of μ. Which of the following is **not** necessary?
    A) We must assume the population has a normal distribution.
    B) We must use a *t* distribution.
    C) Sample standard deviation must be used to estimate σ.
    D) The sample must have a normal distribution.

19. For a two-tail test, the *p*-value is the probability of obtaining a value for the test statistic as
    A) likely as that provided by the sample
    B) unlikely as that provided by the sample
    C) likely as that provided by the population
    D) unlikely as that provided by the population

（背面仍有題目，請繼續作答）

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

20. Which of the following does **not** need to be known in order to compute the *p*-value?
A) knowledge of whether the test is one-tailed or two-tailed
B) the value of the test statistic
C) the level of significance
D) None of these alternatives is correct.

21. According to a report, the mean salary for mayors in all Taiwan's cities is $120,000. A newspaper believes that this figure is not correct, and wishes to assess the evidence against it. A reporter at the newspaper takes a simple random sample of 10 Taiwan's cities, and finds that the mean salary for mayors in those cities is $132,200.

What would a suitable *null hypothesis* for a test of significance say?
A) The sample mean salary is equal to $132,200.
B) The mean salary of all mayors is equal to $120,000.
C) The mean salary of all mayors is not equal to $120,000.
D) The sample mean salary is not equal to $132,200.

22. Testing the equality of three or more population proportions
A) is not possible, since proportions deal with only two possible outcomes
B) uses a *t* test
C) is the same as test of goodness of means
D) uses a chi-square test

23. In order to determine whether or not the means of two populations are equal,
A) a *t* test must be performed
B) an analysis of variance must be performed
C) either a *t* test or an analysis of variance can be performed
D) a chi-square test must be performed

24. Compared to the confidence interval estimate for a particular value of *y* (in a linear regression model), the interval estimate for an average value of *y* will be
A) narrower
B) wider
C) the same
D) None of these alternatives is correct.

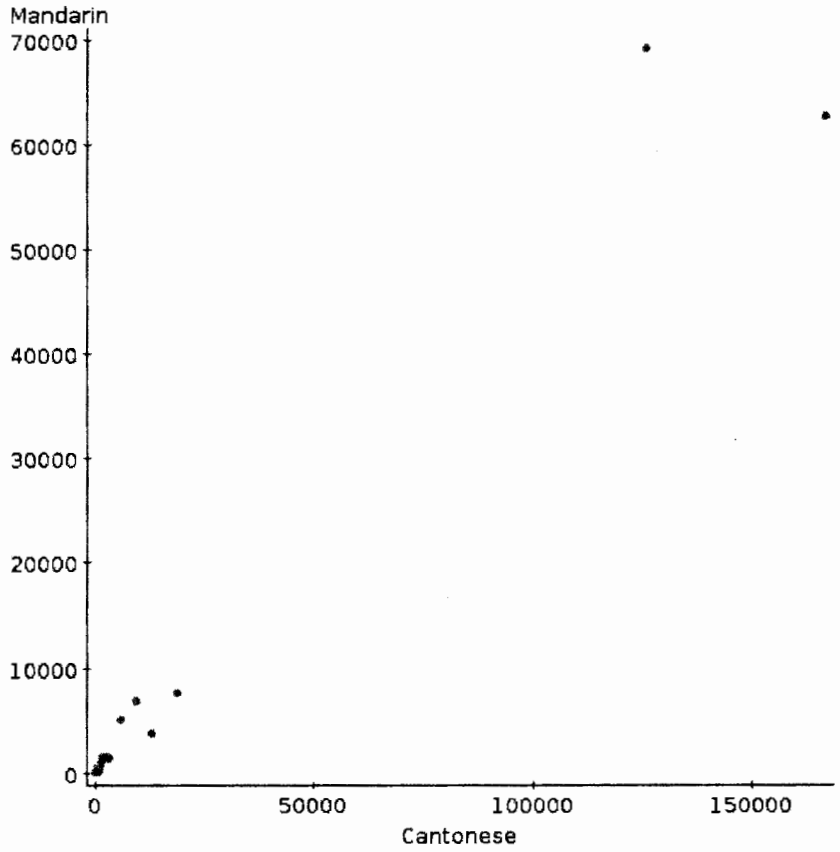
[Presidential Approval Ratings] In a sample of 1,600 registered voters, 912, or 57%, approve of the way the President is doing his job. Use this information for Questions 25 and 26.

25. **[Presidential Approval Ratings]** The 57% approval is an example of
A) a sample
B) descriptive statistics
C) statistical inference
D) a population

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

26. **[Presidential Approval Ratings]** A political pollster states: "Fifty-seven percent of all voters approve of the President." This statement is an example of
A) a sample
B) descriptive statistics
C) statistical inference
D) a population

27. For each of a number of cities across a particular country, the number of people with Cantonese as a mother tongue and the number of people with Mandarin as a mother tongue were recorded. A scatterplot of the data is shown below.



The correlation between the number of Cantonese speakers in a city and the number of Mandarin speakers is 0.980. Do you think this correlation is a reasonable summary of the relationship? Why, or why not?

A) Yes, because there are no influential points.
B) No, because the relationship is clearly curved.
C) No, because there are outliers and/or influential points.
D) Yes, because the relationship is more or less linear.

（背面仍有題目，請繼續作答）

國立成功大學 104 學年度碩士班招生考試試題

系所組別：經濟學系

考試科目：統計學

考試日期：0211，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

28. Some people have been complaining that the children's playground at a certain city park is in need of repair. Any repairs will need to be paid for from city taxes. The city will commission a survey on this issue. The survey question is planned to be "the city should allot more funds for the maintenance and repair of children's playgrounds in city parks". What would be the best way to conduct the survey?
    A) draw a probability sample from all city taxpayers and contact the sampled taxpayers by phone, following up if necessary
    B) hand out surveys to parents of all children at some randomly chosen city parks
    C) use a web site like `surveymonkey.com` to host the survey and advertise it to all city taxpayers.
    D) draw a probability sample from all city taxpayers and contact the sampled tax-payers by phone. If the phone is not answered, ignore this taxpayer and move on to the next.

29. A car rental company records the number of kilometers driven per day by each of its customers, and finds that the number of kilometers driven has a mean of 110 km and a standard deviation of 80 km. Based on this information, what do you think is the shape of the distribution of the number of kilometers driven?
    A) Skewed to the left
    B) Skewed to the right
    C) Like a normal distribution
    D) Symmetric but not normal

30. Vehicle speeds at a certain highway location have a mean of 100 km/h and a standard deviation of 10 km/h, with a distribution that is approximately normal. A simple random sample of 25 vehicles is taken. There is a 95% chance that the mean speed of the sampled vehicles is between which of the values below, in km/h?
    A) 96 and 104
    B) 97 and 103
    C) 99.6 and 100.4
    D) 98 and 102

31. In a game you toss a fair coin once. You win \$20 if a head comes up and you lose \$10 if a tail comes up. Let the random variable X denote the amount of money you win. (Losing \$10 means winning -\$10.) What is the standard deviation of X, in dollars?
    A) 5
    B) 10
    C) 12.50
    D) 15

32. You toss 2 fair coins and count the number of heads. Independently, your friend tosses 3 fair coins and counts the number of heads. The winner is the player who gets more heads when they toss their coins. What is the probability that you win?
    A) 0.04
    B) 0.19
    C) 0.39
    D) 0.50

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

33. Suppose you arrive at the NCKU bus stop. You have exactly 4 minutes to wait for your bus. While you are waiting, you observe other buses that are leaving. The time until the next number 38 bus leaves is a random variable with a (continuous) uniform distribution between 0 and 6 minutes; independently of that, the time until the next number 95 bus leaves is a random variable with a uniform distribution between 0 and 10 minutes. What is the probability that, while you are waiting, you observe a number 38 bus leaving, but you do not observe a number 95 bus leaving?
A) 0.13
B) 0.20
C) 0.27
D) 0.40

[Cell Phone Ban] Should cell phone use be banned by drivers? 188 people took part in a survey. The answers are classified by the gender of the respondent as below:

	Agree	Disagree
Female	68	37
Male	26	46

Use this information for Questions 34 through 36.

34. **[Cell Phone Ban]** What is the conditional proportion of females who agree?
A) 0.45
B) 0.55
C) 0.60
D) 0.65

35. **[Cell Phone Ban]** Refer to the information given. What is the marginal proportion of people who agree?
A) 0.55
B) 0.60
C) 0.65
D) 0.72

36. **[Cell Phone Ban]** Refer to the information given. Is there an association between gender and the response given on the survey?
A) No, because the proportions of females and males who agree are very similar.
B) Association here has nothing to do with what proportions of males and females agree.
C) Yes, because the proportion of females who agree is lower than the proportion of males who agree.
D) Yes, because the proportion of females who agree is higher than the proportion of males who agree.

（背面仍有題目，請繼續作答）

國立成功大學 104 學年度碩士班招生考試試題

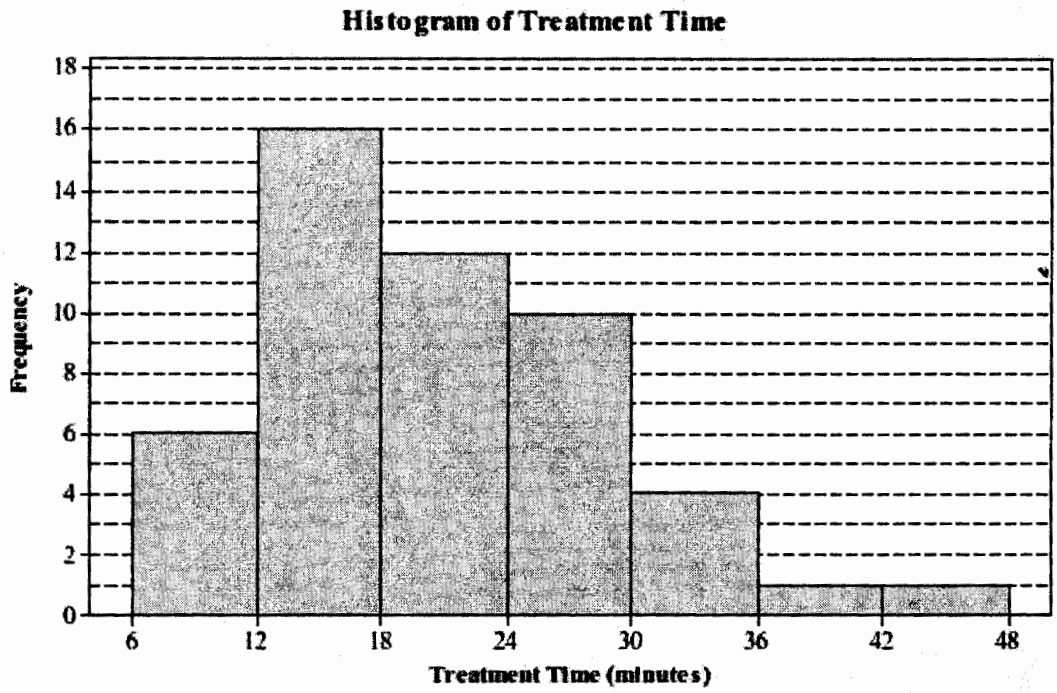
系所組別：經濟學系

考試科目：統計學

考試日期：0211，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

37. 50 patients visited a health clinic. Their treatment times are shown in the histogram below.



Consider the following three statements, each of which is either true or false:

I: The median treatment time is between 24 and 30 minutes.
II: The largest possible value for the mean treatment time is less than 24 minutes.
III: The smallest possible value for the mean treatment time is greater than 17 minutes.

Which of these statements is (are) true?

A) all of the statements are true
B) statements II and III only
C) statements I and III only
D) statements I and II only

38. A researcher expects a relationship between two variables, but finds that the correlation between them is close to zero. The researcher has plenty of data. What is a possible explanation?

A) The relationship is a curve.
B) The relationship is strongly linear but the correlation happened to come out close to zero.
C) The relationship is a curved upward trend.
D) There cannot actually be a relationship between the variables if the correlation is close to zero.

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

[Comparing Group Means] Suppose a simple random sample of 10 observations $X_1, X_2,..., X_{10}$ is taken from a normally distributed population with mean 20 and standard deviation 2. Let $\overline{X}$ denote the mean of this sample. Independently of this, another simple random sample of 10 observations $Y_1, Y_2,..., Y_{10}$ is taken from another normally distributed population with mean 10 and standard deviation 1. Let $\overline{Y}$ denote the mean of this sample. Use this information for Questions 39 and 40.

39. **[Comparing Group Means]** Consider the random variable $X_{10}-Y_1$ (the 10th value in the first sample minus the first value in the second sample). This random variable has a normal distribution. What are its mean and standard deviation (respectively)?
A) 0 and 1
B) 10 and 3
C) 0 and $\sqrt{5}$
D) 10 and $\sqrt{5}$

40. **[Comparing Group Means]** Using the information given, consider the random variable $\overline{X}-\overline{Y}$. What is the distribution of this random variable?
A) normal with mean 10 and standard deviation 0.7
B) standard normal
C) a t distribution with 9 degrees of freedom
D) normal with mean 10 and standard deviation 0.3

41. What does the Central Limit Theorem say?
A) The sampling distribution of the sample mean is approximately normal for large samples.
B) If the sample is large, the population from which the sample comes is approximately normal.
C) The sampling distribution of the sample standard deviation is approximately normal for large samples.
D) The sample mean is likely to be very close to the population mean if the sample is large.

42. A 2004 survey of the world's countries found a strong positive correlation between the percentage of the country's population regularly using cellphones and life expectancy at birth (in years). What can you conclude from this?
A) Cellphone use and life expectancy are confounded
B) In countries where cellphone use is low, cellphone use should be encouraged in order to increase life expectancy
C) Using cellphones is good for your health
D) Some other variable is the cause of the high correlation

（背面仍有題目，請繼續作答）

國立成功大學 104 學年度碩士班招生考試試題

系所組別：經濟學系

考試科目：統計學

考試日期：0211，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

43. The salaries paid to the 13 employees of a small market research company are as follows: the five telephone interviewers are each paid $32,000; three administrative assistants are paid $48,000; three data analysts are paid $55,000, one supervisor is paid $65,000 and one senior manager is paid $160,000.

What is the median salary of these 13 employees?

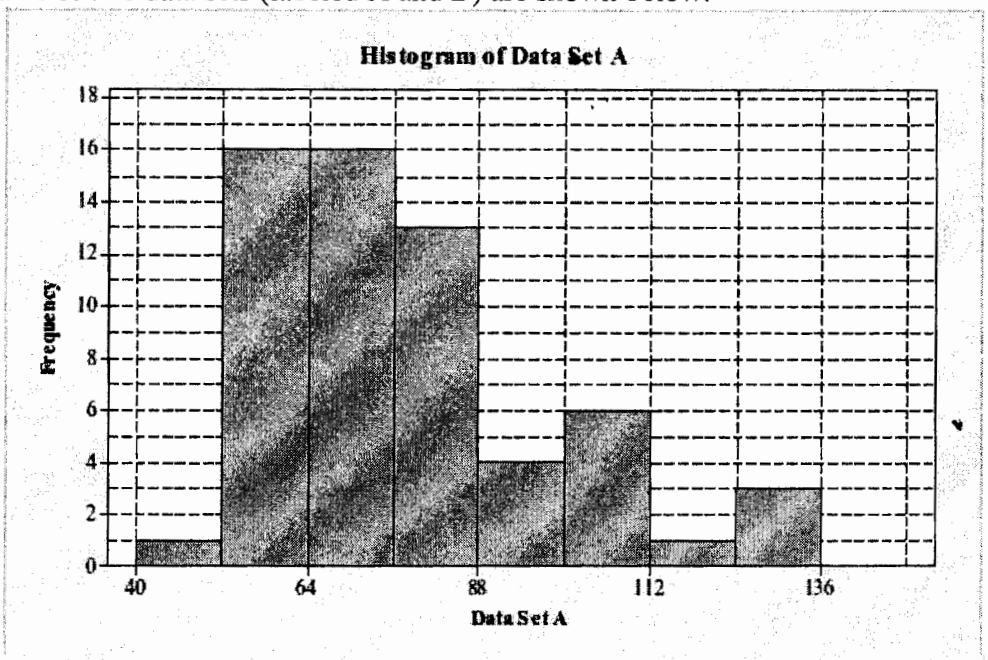
A) $40,000
B) $60,000
C) $48,000
D) $55,000

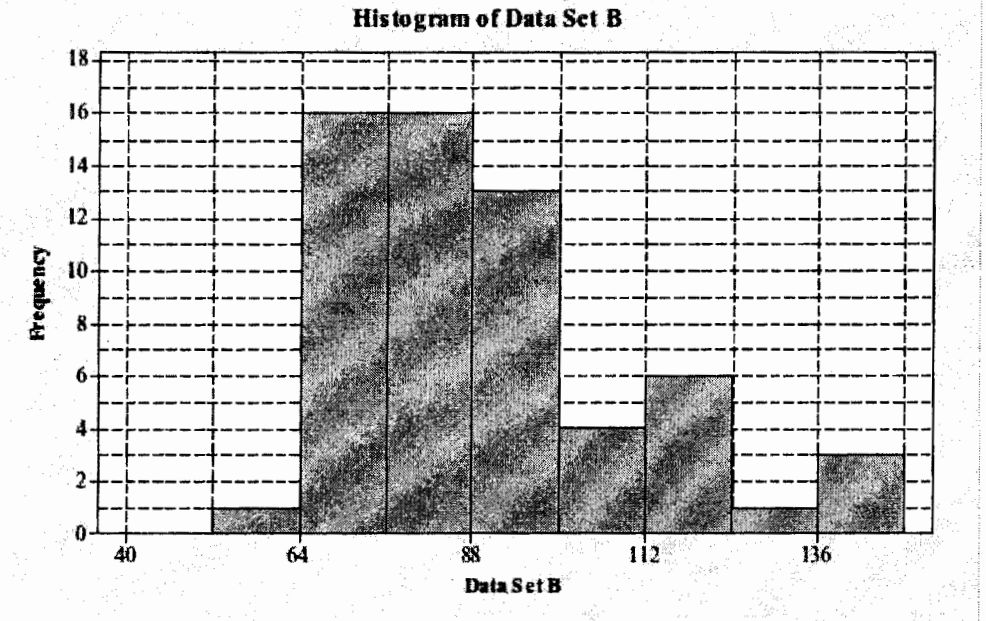
44. A study was carried out to determine whether a new diet is effective in reducing cholesterol levels. Twenty subjects were recruited. For each subject, the cholesterol level was measured initially. Each subject was placed on the new diet for one month, and then that subject's cholesterol level was measured again. Which of the following methods of analysis is most appropriate?

A) One-sided matched pairs *t* test.
B) Two-sided two-sample *z*-test.
C) Two-sided two-sample *t* test.
D) One-sided two-sample *t* test.

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

45. The histograms of two data sets (labeled A and B) are shown below:





Descriptive statistics for data set A are also given below:

```
Descriptive Statistics: Data Set A

Variable        N    Mean   SE Mean   StDev      Q1      Q3
Data Set A     60   78.43      2.57   19.92   62.95   86.58
```

（背面仍有題目，請繼續作答）

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Which of the following could be the mean of data set B?
A) 58.43
B) 78.43
C) 98.43
D) 90.43

46. The probability that a US resident has visited Canada is 0.18, the probability that a US resident has visited Mexico is 0.09, and the probability that a US resident has visited both countries is 0.04. Consider the events "has visited Canada" and "has visited Mexico", as applied to a randomly-chosen US resident. Are these two events independent? Are they disjoint? What can you say about these events?
A) They are independent but not disjoint
B) They are disjoint but not independent
C) They are both independent and disjoint
D) They are neither independent nor disjoint

47. It is desired to estimate the mean of a population using a 95% confidence interval. The population is known to have a highly skewed shape. A sample of size 45 is proposed. What do you think of this choice of sample size?
A) the sample size may not be large enough to allow the Central Limit Theorem to apply
B) the sample size is bigger than 30, so the calculation should be accurate
C) the sampling distribution of the sample mean has exactly a normal shape regardless of the shape of the population
D) The Law of Large Numbers says that the sample mean and population mean will be close, so there is no need to calculate a confidence interval

48. Following the analysis of a well-designed completely randomized experiment it was reported that the observed effect was "statistically significant". Which of the following statements best explains the meaning of the phrase "statistically significant"?
A) The observed result made sense to the experimenter since it was what was hoped would happen.
B) The observed effect happened because the experiment was properly designed and carried out without bias.
C) The laws of probability say that this observed result would be expected to happen by chance.
D) The observed effect was sufficiently large so that it would rarely occur simply by chance.

國立成功大學 104 學年度碩士班招生考試試題

系所組別：經濟學系

考試科目：統計學

考試日期：0211，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

[Test of Significance] A random variable X might have one of two probability distributions. The null hypothesis is that X has this distribution:

Value	**0**	**1**	**2**	**3**
Probability	0.50	0.40	0.08	0.02

The alternative hypothesis is that X has this distribution:

Value	**0**	**1**	**2**	**3**
Probability	0.10	0.30	0.35	0.25

A test of significance is carried out by observing one value of X, and rejecting the null hypothesis in favor of the alternative if the observed value is 2 or larger. Use this information for Questions 49 and 50.

49. **[Test of Significance]** What is the probability of a Type I error for this test?
A) 0.05
B) 0.08
C) 0.10
D) 0.60

50. **[Test of Significance]** What is the probability of a Type II error for this test?
A) 0.10
B) 0.35
C) 0.40
D) 0.60