國立臺北大學 106 學年度碩士班一般入學考試試題

系（所）組別：都市計劃研究所甲、乙組

科　　目：統計學

☑可 ☐不可使用計算機

Part I (100%) 單選題

1. Suppose we want to visualize the distribution of type localities (地質種類) for 1000 sample points. What is the most appropriate chart?
   (A) Bar chart
   (B) Box plot
   (C) Histogram
   (D) QQ plot
   (E) Scatter plot
2. Which of the following is the most appropriate chart to visualize the relationship between type localities and the landslide density (崩塌地密度)?
   (A) Bar chart
   (B) Box plot
   (C) Histogram
   (D) Scatter plot
   (E) Stem and leaf plot.
3. Which of the following is the most appropriate chart to visualize the association between altitude (海拔高度) and the landslide density?
   (A) Bar chart
   (B) Box plot
   (C) Histogram
   (D) Scatter plot
   (E) Stem and leaf plot.
4. Suppose we would like to know the central tendency of the landslide density for a given sample? Which is the most appropriate measure?
   (A) Coefficient of variation
   (B) Frequency
   (C) Interquartile
   (D) Maximum
   (E) Median
5. Suppose we would like to know the variability of the landslide density for a given sample? Which of the following measure is not appropriate?
   (A) Coefficient of correlation
   (B) Coefficient of variation
   (C) Interquartile
   (D) Range
   (E) Variance
6. Which of the following is the most appropriate measure to summarize the association between altitude and the landslide density?
   (A) Coefficient of correlation
   (B) Coefficient of variation
   (C) Interquartile
   (D) Range
   (E) Variance

7. A student didn't prepare for an important exam. Suppose this exam includes 25 multiple-choice questions, where each question has 5 choices and only one of 5 choices is correct. On the average, how many correct answers will this student get?
   (A) 0.25
   (B) 1
   (C) 2.5
   (D) 5
   (E) 10
8. In a hospital, sixty percent of patients are dying of a disease. If on a certain day, eighth patients got admitted in the hospital for that disease what are the chances of only one to survive?
   (A) 0
   (B) 0.001
   (C) 0.008
   (D) 0.011
   (E) 0.090
9. The number of calls coming per hour into a hotel reservation center is a Poisson random variable with mean number of 6 calls per hour. What is the probability that no calls come in a given 30 minutes period?
   (A) 0
   (B) e^{-6}
   (C) e^{-3}
   (D) $1-e^{-3}$
   (E) $1-e^{-6}$
10. A radar unit is used to measure speeds of cars on a motorway. The speeds are normally distributed with a mean of 90 km/hr and a standard deviation of 10 km/hr. What is the probability that a car picked at random is travelling at more than 100 km/hr?
    (A) 0
    (B) 0.159
    (C) 0.5
    (D) 0.841
    (E) 0.999
11. The length of similar components produced by a company is approximated by a normal distribution with a mean of 5 cm and a standard deviation of 0.02 cm. If a component is chosen at random, what is the probability that the length of this component is between 4.98 and 5.02 cm?
    (A) 0.016
    (B) 0.159
    (C) 0.318
    (D) 0.682
    (E) 0.841
12. The company JCrew advertises that 95% of its online orders ship within two working days. You select a random sample of 200 of the 10,000 orders received over the past month to audit. The audit reveals that 180 of these orders shipped on time. What is the percent of orders shipped on time?
    (A) 0.02
    (B) 0.1
    (C) 0.9
    (D) 0.95
    (E) 1

13. A bottling company uses a machine to fill the bottles with olive oil. The bottles are designed to contain 475 milliliters (ml). In fact, the contents vary according to a normal distribution with a mean of 473 ml and standard deviation of 3 ml. What is the probability that the mean of six bottles is less than 470 ml?
    (A) 0
    (B) 0.007
    (C) 0.051
    (D) 0.507
    (E) 0.551
14. An education researcher has developed a new technique to teach Spanish to high school students. To prove this new method is better, she will teach two groups of students for an entire semester, one with the new method and one with the standard method used today in high schools. She wishes to obtain 12 sets of identical twins, 24 people total, and split the twins up so that one of each twin is in Class 1, which will receive the new technique, and one is in Class 2, which will receive the old technique. At the end of the semester both classes will take a standardized exam and the results will be compared. What method should be used to analyze this data?
    (A) Chi-square test
    (B) One sample *t* test
    (C) Paired *t* test
    (D) Two independent samples *t* test
    (E) Two independent sample proportions test
15. Continued 14., suppose we collect the data from this experiment and we find a *p*-value of 0.009. Which of the following is our conclusion at a given level $\alpha = 0.05$?
    (A) There is not evidence of a difference between the two educational methods.
    (B) There is evidence that the old method is better than the new method.
    (C) There is evidence that the new method is better than the old method.
    (D) There is evidence that both methods are equally effective.
    (E) We cannot determine without more information.
16. Suppose you conduct a significance test for the population proportion and your *p*-value is 0.09. Given a 0.10 level of significance, which of the following should be your conclusion?
    (A) Accept H_0
    (B) Accept H_a
    (C) Fail to reject H_0
    (D) Fail to reject H_a
    (E) Reject H_0
17. We suspect that men are convicted of DUI (driving under the influence of alcohol or drugs) more often than women. Let p_1 be the proportion of males convicted of a DUI offense and let p_2 be the proportion of females convicted of a DUI offense. If the 95% CI for $p_1 - p_2$ is (-0.163 , -0.02). Which of the following can conclude?
    (A) There is evidence that males have a higher proportion of convictions for DUI than females.
    (B) There is evidence that females have a higher proportion of convictions for DUI than males.
    (C) There is evidence that females have higher sample proportion of convictions.
    (D) There is evidence that males have higher sample proportion of convictions.
    (E) There is not evidence that there is a difference in the proportion of convictions for DUI for male and females.
18. Continued 17., are there any problems with the assumptions necessary for these conclusions to be valid?
    (A) The data does not seem to be from a normal distribution.
    (B) The data may not have been randomly selected and thus not representative of the population.
    (C) The sample sizes may not have been large enough for the formulas to be appropriate.
    (D) There are no problems with this data.
    (E) There may be problems with both randomness and sample sizes.

19. Global warming has gotten a lot of media attention over the past few years, but researchers in Antarctica are keeping track of temperatures at the South Pole to try to see if temperatures really are rising. They know that from 1900-1999 (last century) the average temperature at the South Pole was -6 degrees Celsius. They have randomly sampled 25 days from the past 2 years (this century) and collected the following data:

-6.0 -1.3 -2.4 -0.4 -3.4 2.1 -6.1 6.4 1.1 -4.2 -38.0 -0.1
0.5 -5.8 -3.5 2.8 -6.5 4.3 -1.5 -1.8 1.9 2.8 3.5 0.8 2.1

Let μ denote the average temperature of South Pole for this century and $\mu_i, i=1,2,$ denote the average temperature of South Pole for last and this century. What are the appropriate H_0 and H_a?

(A) $H_0: \mu = -2.1$ versus $H_a: \mu > -2.1$
(B) $H_0: \mu = -6$ versus $H_a: \mu > -6$
(C) $H_0: \mu = -6$ versus $H_a: \mu \neq -6$
(D) $H_0: \mu_1 - \mu_2 = 0$ versus $H_a: \mu_1 - \mu_2 \neq 0$
(E) $H_0: \mu_1 - \mu_2 = 0$ versus $H_a: \mu_1 - \mu_2 > 0$

20. Continued 19., the 98% Confidence Interval obtained from this sample is (-5.99, 1.79). Based on this interval, which of the following statements are true? We are 98% confident that:
(A) The true mean temperature of this century is between 5.99 degrees lower and 1.79 degrees higher than the true mean temperature of last century at the South Pole.
(B) The true mean temperature of this century is between 5.99 degrees higher and 1.79 degrees lower than the true mean temperature of last century at the South Pole.
(C) The true mean temperature of this century is different than the true mean temperature of last century at the South Pole.
(D) The true mean temperature of this century is the same as the true mean temperature of last century at the South Pole.
(E) None of the above statements are true.

21. Is left-handedness associated with gender in some way? Researchers were trying to determine if a connection could be made between the dominant hand and gender in high school students. They randomly sampled 1417 high school students across the country and obtained the following data:

	Male students	Female students
Left handed students	68	97
Right handed students	545	707

What is the population of interest here?

(A) All left-handed high school students in the country
(B) All right-handed high school students in the country
(C) All male high school students in the country
(D) All female high school students in the country
(E) All high school students in the country.

22. Continued 21., which of the following can not be used to analyze this?
    (A) Chi-square test
    (B) Confidence interval
    (C) Paired *T* test
    (D) Two independent sample *T* test
    (E) Two independent sample proportions test

23. Continued 21. The 95% CI was (-0.0430, 0.0242). What can we conclude about the proportions of left-handed students among male and female high school students at the 95% confidence level?
    (A) The true proportion of male students that are left-handed is higher than the true proportion of female students that are left-handed.
    (B) The true proportion of male students that are left-handed is lower than the true proportion of female students that are left handed.
    (C) The true proportion of male students that are left-handed is equal to the true proportion of female students that are left-handed.
    (D) The sample proportion of male students that are left-handed is equal to the sample proportion of female students that are left-handed.
    (E) We cannot conclude that the true proportion of male students that are left-handed is different from the true proportion of female students that are left-handed.

24. Lithium carbonate is a drug used to treat bipolar mental disorders. The average dose in well- maintained patients is $\mu = 1.3$ mEq/L. A random sample of 25 patients on lithium demonstrates a mean lithium level of 1.4 mEq/L and a standard deviation $s = 0.3$ mEq/L. Conduct a one sample t test to see if the observed difference is significant. Use a two-sided alternative, as improper dosing would include both under- and over-dosing. What is the p-value for this test?
    (A) Between 0.01 and 0.025
    (B) Between 0.01 and 0.05
    (C) Between 0.05 and 0.1
    (D) Between 0.1 and 0.2
    (E) None of the above

25. Professor Joel Gelfand of the University of Pennsylvania in Philadelphia, led a study analyzing data collected by the federal Centers for Disease Control and Prevention about a random sample of 207,776 Americans 18 and older and compared the incidence of sunburn in the previous year for those without a high school degree (group 1) and those who had graduated from college (group 2). Let p_1, p_2 denote the incidence of sunburn for groups 1 and 2 and let p_1, p_2 denote the sample incidence of sunburn for groups 1 and 2. A newspaper article reported this with a headline that read "Smartest People Often Dumbest About Sunburns". Assuming "smartest people" refers to college grads, the alternative hypothesis to test this statement is:
    (A) $p_1 - p_2 < 0$
    (B) $p_1 - p_2 > 0$
    (C) $\hat{p}_1 - \hat{p}_2 < 0$
    (D) $\hat{p}_1 - \hat{p}_2 > 0$
    (E) $\hat{p}_1 - \hat{p}_2 \neq 0$

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Table 1: Area under the standard normal curve

	$P[Z \le z]$									
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.00	0.500	0.504	0.508	0.512	0.516	0.519	0.523	0.527	0.531	0.535
0.10	0.539	0.543	0.547	0.551	0.555	0.559	0.563	0.567	0.571	0.575
0.20	0.579	0.583	0.587	0.591	0.594	0.598	0.602	0.606	0.610	0.614
0.30	0.617	0.621	0.625	0.629	0.633	0.636	0.640	0.644	0.648	0.651
0.40	0.655	0.659	0.662	0.666	0.670	0.673	0.677	0.680	0.684	0.687
0.50	0.691	0.695	0.698	0.701	0.705	0.708	0.712	0.715	0.719	0.722
0.60	0.725	0.729	0.732	0.735	0.738	0.742	0.745	0.748	0.751	0.754
0.70	0.758	0.761	0.764	0.767	0.770	0.773	0.776	0.779	0.782	0.785
0.80	0.788	0.791	0.793	0.796	0.799	0.802	0.805	0.807	0.810	0.813
0.90	0.815	0.818	0.821	0.823	0.826	0.828	0.831	0.834	0.836	0.838
1.00	0.841	0.843	0.846	0.848	0.850	0.853	0.855	0.857	0.859	0.862
1.10	0.864	0.866	0.868	0.870	0.872	0.874	0.877	0.879	0.881	0.883
1.20	0.884	0.886	0.888	0.890	0.892	0.894	0.896	0.898	0.899	0.901
1.30	0.903	0.904	0.906	0.908	0.909	0.911	0.913	0.914	0.916	0.917
1.40	0.919	0.920	0.922	0.923	0.925	0.926	0.927	0.929	0.930	0.931
1.50	0.933	0.934	0.935	0.937	0.938	0.939	0.940	0.941	0.942	0.944
1.60	0.945	0.946	0.947	0.948	0.949	0.950	0.951	0.952	0.953	0.954
1.70	0.955	0.956	0.957	0.958	0.959	0.959	0.960	0.961	0.962	0.963
1.80	0.964	0.964	0.965	0.966	0.967	0.967	0.968	0.969	0.969	0.970
1.90	0.971	0.971	0.972	0.973	0.973	0.974	0.975	0.975	0.976	0.976
2.00	0.977	0.977	0.978	0.978	0.979	0.979	0.980	0.980	0.981	0.981
2.10	0.982	0.982	0.983	0.983	0.983	0.984	0.984	0.985	0.985	0.985
2.20	0.986	0.986	0.986	0.987	0.987	0.987	0.988	0.988	0.988	0.989
2.30	0.989	0.989	0.989	0.990	0.990	0.990	0.990	0.991	0.991	0.991
2.40	0.991	0.992	0.992	0.992	0.992	0.992	0.993	0.993	0.993	0.993
2.50	0.993	0.994	0.994	0.994	0.994	0.994	0.994	0.994	0.995	0.995
2.60	0.995	0.995	0.995	0.995	0.995	0.996	0.996	0.996	0.996	0.996
2.70	0.996	0.996	0.996	0.996	0.996	0.997	0.997	0.997	0.997	0.997
2.80	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.997	0.998	0.998
2.90	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998
3.00	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.999	0.999

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Table 2 Selected quantiles of the t distribution

	$P[T \le t]$				
r	0.900	0.950	0.975	0.99	0.995
1	3.08	6.31	12.71	31.82	63.66
2	1.89	2.92	4.30	6.96	9.92
3	1.64	2.35	3.18	4.54	5.84
4	1.53	2.13	2.78	3.75	4.60
5	1.48	2.02	2.57	3.36	4.03
6	1.44	1.94	2.45	3.14	3.71
7	1.41	1.89	2.36	3.00	3.50
8	1.40	1.86	2.31	2.90	3.36
9	1.38	1.83	2.26	2.82	3.25
10	1.37	1.81	2.23	2.76	3.17
11	1.36	1.80	2.20	2.72	3.11
12	1.36	1.78	2.18	2.68	3.05
13	1.35	1.77	2.16	2.65	3.01
14	1.35	1.76	2.14	2.62	2.98
15	1.34	1.75	2.13	2.60	2.95
16	1.34	1.75	2.12	2.58	2.92
17	1.33	1.74	2.11	2.57	2.90
18	1.33	1.73	2.10	2.55	2.88
19	1.33	1.73	2.09	2.54	2.86
20	1.33	1.72	2.09	2.53	2.85
21	1.32	1.72	2.08	2.52	2.83
22	1.32	1.72	2.07	2.51	2.82
23	1.32	1.71	2.07	2.50	2.81
24	1.32	1.71	2.06	2.49	2.80
25	1.32	1.71	2.06	2.49	2.79
26	1.31	1.71	2.06	2.48	2.78
27	1.31	1.70	2.05	2.47	2.77
28	1.31	1.70	2.05	2.47	2.76
29	1.31	1.70	2.05	2.46	2.76
30	1.31	1.70	2.04	2.46	2.75

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