※ 請依序作答，並標明作答之大題及其題號。

1. When performing sample size estimation as writing a proposal for epidemiological study, what factors should be considered in the sample size calculation? (8%)

2. What is(are) the difference between parametric and non-parametric statistical methods? (7%)

3. Please describe random sampling, cluster sampling and stratification sampling, respectively. (8%)

4. The table shown below presents the results of a study among 259 workers of a steel company. Numbers presented in this table are the frequency of workers in each category by hearing loss level, blood lead level and noise level at workplace. Based on this table, (1) what is the hypothesis you may propose to test for this study? (2) what statistical method you may adopt to examine the hypothesis you set, and why? (not necessary to calculate the data) (3) how do you interpret the findings resulting from the statistical analysis with the viewpoint of epidemiology? (27%)

	Hearing Loss	
Variable	≦25 dB	>25 dB
Blood Lead		
≦4 μg/dL	89	7
4~7 μg/dL	82	23
≧7 μg/dL	35	23
Noise Level		
≦80 dB	45	9
>80 dB	161	44

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5. To study the difference and relationship of identical twins' birth weights (in kilograms), a small sample (n = 8) is given below where X represents the weight of the firstborn and Y represents the weight of the second born twin. Assume the requirements for the simple linear regression model are fulfilled. (25%)

Twin pair	1	2	3	4	5	6	7	8
X: weight of the firstborn twin in kilograms	2.5	2.8	3.2	2.3	2.2	2.7	2.4	2.7
Y: weight of the second born twin in kilograms	2.3	2.7	3.1	2.3	2.2	2.5	2.3	2.2
D: Difference in weight between the firstborn and second born twins in kilograms	0.2	0.1	0.1	0.0	0.0	0.2	0.1	0.5

(1) Plot the data.
(2) Calculate the means and 95% confidence intervals of the firstborn and second born twins.
(3) Are the firstborn twins' weights different from the second born twins' weights? Test the hypothesis $\mu_D = 0$.
(4) Estimate the least squares line ($Y = a + bX$) summarizing the relationship between second born twins' weights (Y) and firstborn twins' weights (x).
(5) Are the second born twins' weights related to the firstborn twins' weights? Test the hypothesis $\beta = 0$.

6. Please explain the following terms in epidemiology. (25%)
(1) Attributable fraction.
(2) Case-crossover design.
(3) Exposure misclassification.
(4) Gene-environment interaction.
(5) Selection bias.

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Table　Two-sided *P*-values for the *t* distribution, according to the value of the test statistic.

The final column shows *P*-values for infinite degrees of freedom, equivalent to *P*-values from the normal distribution.

Value of test statistic (*t*)	Degrees of freedom for *t*							
	5	6	7	8	9	10	12	14
1.5	0.194	0.184	0.177	0.172	0.168	0.165	0.159	0.156
1.6	0.170	0.161	0.154	0.148	0.144	0.141	0.136	0.132
1.7	0.150	0.140	0.133	0.128	0.123	0.120	0.115	0.111
1.8	0.132	0.122	0.115	0.110	0.105	0.102	0.097	0.093
1.9	0.116	0.106	0.099	0.094	0.090	0.087	0.082	0.078
2.0	0.102	0.092	0.086	0.081	0.077	0.073	0.069	0.065
2.1	0.090	0.080	0.074	0.069	0.065	0.062	0.058	0.054
2.2	0.079	0.070	0.064	0.059	0.055	0.052	0.048	0.045
2.3	0.070	0.061	0.055	0.050	0.047	0.044	0.040	0.037
2.4	0.062	0.053	0.047	0.043	0.040	0.037	0.034	0.031
2.5	0.054	0.047	0.041	0.037	0.034	0.031	0.028	0.025
2.6	0.048	0.041	0.035	0.032	0.029	0.026	0.023	0.021
2.7	0.043	0.036	0.031	0.027	0.024	0.022	0.019	0.017
2.8	0.038	0.031	0.027	0.023	0.021	0.019	0.016	0.014
2.9	0.034	0.027	0.023	0.020	0.018	0.016	0.013	0.012
3.0	0.030	0.024	0.020	0.017	0.015	0.013	0.011	0.010
3.1	0.027	0.021	0.017	0.015	0.013	0.011	0.009	0.008
3.2	0.024	0.019	0.015	0.013	0.011	0.009	0.008	0.006
3.3	0.021	0.016	0.013	0.011	0.009	0.008	0.006	0.005
3.4	0.019	0.014	0.011	0.009	0.008	0.007	0.005	0.004
3.5	0.017	0.013	0.010	0.008	0.007	0.006	0.004	0.004
3.6	0.016	0.011	0.009	0.007	0.006	0.005	0.004	0.003
3.7	0.014	0.010	0.008	0.006	0.005	0.004	0.003	0.002
3.8	0.013	0.009	0.007	0.005	0.004	0.003	0.003	0.002
3.9	0.011	0.008	0.006	0.005	0.004	0.003	0.002	0.002
4.0	0.010	0.007	0.005	0.004	0.003	0.003	0.002	0.001
4.1	0.009	0.006	0.005	0.003	0.003	0.002	0.001	0.001
4.2	0.008	0.006	0.004	0.003	0.002	0.002	0.001	0.001
4.3	0.008	0.005	0.004	0.003	0.002	0.002	0.001	0.001
4.4	0.007	0.005	0.003	0.002	0.002	0.001	0.001	0.001
4.5	0.006	0.004	0.003	0.002	0.001	0.001	0.001	<0.001
4.6	0.006	0.004	0.002	0.002	0.001	0.001	0.001	<0.001
4.7	0.005	0.003	0.002	0.002	0.001	0.001	0.001	<0.001
4.8	0.005	0.003	0.002	0.001	0.001	0.001	<0.001	<0.001
4.9	0.004	0.003	0.002	0.001	0.001	0.001	<0.001	<0.001
5.0	0.004	0.002	0.002	0.001	0.001	0.001	<0.001	<0.001

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