

1. What are the etiology and mechanisms of work-related cardiovascular diseases? (20%)
2. What are the causes of work-related low back pain? What elements should be asked in evaluating the possibility of work-related low back pain? What are the effective strategies for preventing low back pain in working populations? (20%)
3. Please state the health effects of the following metals: 1) lead, 2) mercury, 3) cadmium, 4) manganese, and 5) arsenic. (20%)
4. What are the major steps of exposure assessment strategy? Give an example to demonstrate how this strategy can be applied. (20%)
5. Please explain the following terms 1) breathing zone, 2) exposure rate, 3) risk assessment, 4) similar exposure group, and 5) threshold limit value. (20%)

試題 第1頁

1. A set of data as follows:

i	X_i (Treatment)	Y_i (Response)
1	30	73
2	20	50
3	60	128
4	80	170
5	40	87
6	50	108
7	60	135
8	30	69
9	70	148
10	60	132

IF we consider a basic regression model and the model is stated as follows:

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i$$

- To find "good" estimators of the regression parameters β_0 and β_1 , we shall employ the method of least squares. Please illustrate the calculation of the least squares estimators of β_0 and β_1 . (4 pt)
 - There is an important theorem to describe the properties of least squares estimators. What is it? What does this theorem state? (8 pt)
 - What will be the sum of the residuals? (4 pt)
 - The general analysis of variance approach provides highly useful tests for regression models. The test statistics for the analysis of variance approach is $F^* = MSR/MSE$. What are the null and alternative hypotheses for the test? (4 pt)
2. Overwhelming risk factors for lung cancer are well known. However, there are still moderate risk factors to affect people. If you will be studying a moderate risk factor in the presence of overwhelming risk factors, a matched case-control study can be a common strategy for reducing confounding and improving efficiency. However, there are several fundamental problems associated with matching. (a) What are they? (8 pt) (b) If information about the odds ratios or incidence rates for confounding variables (Age, sex) or overwhelming risk factors (e.g., smoking) is available to you, please design a sampling approach to select subjects for studying your concern of a moderate risk factor for the development of lung cancer. (10 pt)

3. Observation bias is relevant to the measurement of the dependent variables in the study. Please identify methods to control observation bias in case-control or cohort study. (10 pt)
4. After establishing smoking as a major risk factor for lung cancer, the next question that excites the researchers or health professionals is "who is at greater risk of developing lung cancer after exposed to smoking". Genetic polymorphism may play a role in modifying the disease risk. Please construct a contingency table to illustrate your study design and study population. (10 pt)
5. Random error can occur in any epidemiologic studies or experimental studies. The validity of study is determined by the extent of systematic error (or bias) that is avoided or minimized. Random error can be reduced by increasing sample size. However, systematic error cannot be reduced by increasing sample size. What are these major validity issues? Please elaborate. (12 pt)
6. Proportional hazards regression is used by authors to investigate survival or other similar time-related events. (a) What is the proportional hazards assumption? (6 pt)
In a study of the risk of cardiovascular disease, the hazards ratios that were statistically significant are shown below.

Risk factor	Hazards ratio	<i>p</i>
Family history	2.55	0.0089
Smoking, package-year	1.77	0.0001
Alcohol, per 10oz wine	1.89	0.0028

- (b) What does the hazards ratio 1.89 for alcohol per 10oz wine mean? (4 pt)
 - (c) Is there an additive or multiplicative effect for the regression component in the proportional hazards model? What will be the hazards ratio if alcohol expressed as per 20oz wine? (4 pt)
7. Please explain the following terms: (4 pt each)
 - a. Density sampling
 - b. Coefficient of determination
 - c. Occupational health surveillance
 - d. Mantel-Haenszel estimate