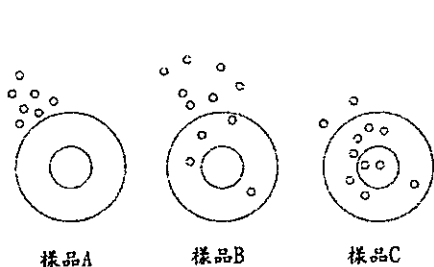


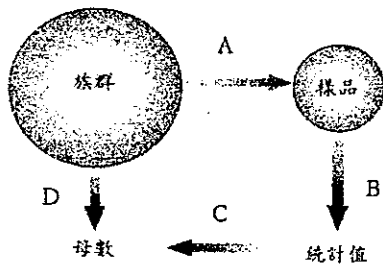
※ 注意：請用 2B 鉛筆作答於答案卡，並先詳閱答案卡上之「畫記說明」。

第一大題. 選擇題 (單選或複選, 每題 3.33 分, 單題的選項全對才得分, 選擇題總分四捨五入到個位數, 滿分為 50 分)

- 圖一中精密度高的樣本為 A.A 樣本 B.B 樣本 C.C 樣本
- 圖二中 ABCD 順序為 A.抽樣,抽樣,計算,抽樣 B.抽樣,計算,推論,計算 C.抽樣,推論,計算,推論
- 計算分組次數分布表要先 A.計算組距 B.決定組數 C.計算相對次數 D.計算絕對次數
- 圖三莖葉圖資料的平均值為 A.92 B.93 C.8.7 D.8.8
- 圖四資料為 A.左偏分布 B.右偏分布 C.左態分布 D.右態分布
- 圖五資料的變異係數為 A.19.68 公斤 B.19.6 公斤 C.20 公斤 D.19.7
- 第一四分位數到第三四分數中必包含 A.第二四分位數 B.中位數 C.75%的資料 D.平均值
- 甲產能 60%良率 98%,乙產能 40%良率 97%,剛好拿到一不良品 A.甲產的機率高 B.乙產的機率高 C.一樣高
- 保險公司壽險額\$20000,保費一年\$300,死亡率 0.1%,保險公司每一顧客利潤期望值為 A.\$280 B.\$290 C.\$299
- 一醫院一天死亡人數為平均值 2 的普瓦松分布,機率最高的一天死亡人數為 A.0 B.1 C.2 D.3
- 圖六資料的平均值的 95%信賴區間會包含 A.4.5 B.4.6 C.6.1 D.6.2
- 假說檢定中決策者有興趣的問題會是甲假說,並期望其乙,甲乙為 A.虛無,成立 B.對立,成立 C.虛無,無法被拒絕 D.對立,無法被拒絕
- 何者正確且意思相同 A.型一錯誤 B.型二錯誤 C.對立假說為真,卻拒絕對立假說 D.偽陽性
- 要提高假說檢定的檢定力可以 A.提高顯著水準 B.降低顯著水準 C.增加試驗樣本數 D.減少試驗樣本數
- 圖七中的 AB 為 A.0.05,0.25 B.0.05,0.10 C.0.95,0.975 D.0.05,0.0975



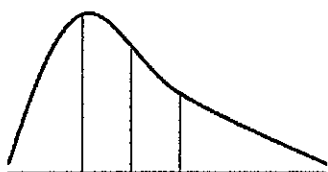
圖一



圖二

次數 (f)	莖 (stem)	葉 (leaf)
3	8	048
12	9	001345566688

圖三



圖四

	\bar{x}	S
體重	62.5	12.3

圖五

12位20-30歲成人血液中尿酸濃度的樣本資料:
 3.8, 4.0, 4.2, 4.2, 4.5, 4.8, 5.4, 5.8, 6.2, 6.8, 7.2, 8.5

圖六

個別比較型 I 誤差機率 $\alpha = 0.05$	
兩兩比較個數	試驗整體型 I 誤差機率
1	A
2	B

圖七

見背面

第二大題. 20 分

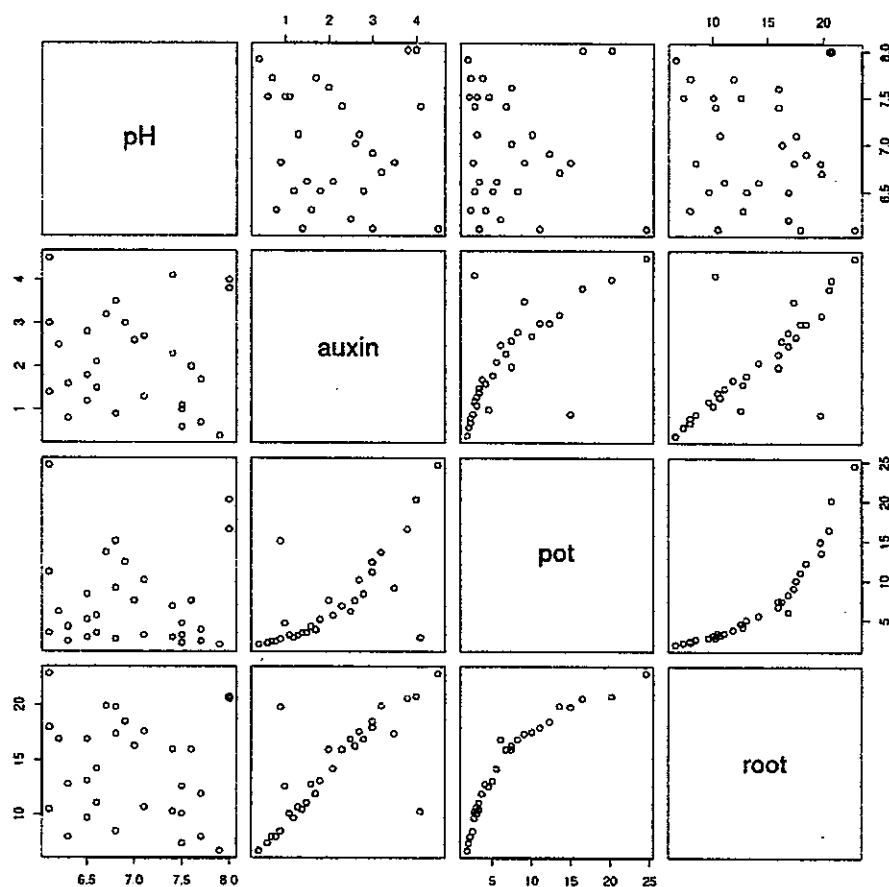
A research team is investigating the impact of various factors on root growth in a particular crop species. They hypothesize that root length is influenced by three main variables: auxin concentration (a plant hormone), soil pH, and pot size. The research team conducts an experiment with 30 plants and measures the auxin concentration (in ng/mL), soil pH, pot size (in L), and the corresponding root length (in cm) after a fixed period of growth.

Analyze the data to determine the relationship between these variables and root length. Conduct hypothesis tests to evaluate the significance and strength of the associations. Comment on the assumptions of the statistical analyses. Discuss the biological implications, limitations, and potential improvements for future research.

	pH	auxin	pot	root
pH	0.364	-0.046	-0.132	-0.366
auxin	-0.046	1.346	4.899	4.128
pot	-0.132	4.899	33.577	24.290
root	-0.366	4.128	24.290	21.197

	pH	auxin	pot	root
pH	1.000	-0.065	-0.038	-0.132
auxin	-0.065	1.000	0.729	0.773
pot	-0.038	0.729	1.000	0.910
root	-0.132	0.773	0.910	1.000

	pH	auxin	pot	root
mean	6.97	2.1	7.29	14.11



第三大題. 30 分

A group of scientists is investigating the effect of different soil compositions on the growth of a popular plant species. They suspect that the soil composition affects the growth of the plants and want to determine which soil mixture results in the best overall growth. They prepare five soil mixtures with varying ratios of sand, silt, and clay.

The experiment randomly assigns 30 plants to each soil mixture, for a total of 150 plants. The plants are grown under controlled conditions in a greenhouse for 12 weeks. Several measurements are taken for each plant at the end of the experiment. Below is a snapshot of the data and a short description of each measurement:

Based on the information provided, describe in detail the complete analytical process you would follow to determine the effect of soil composition on the growth of the plants. Your response should demonstrate a thorough understanding of the entire analytical process, from data preprocessing, statistical analysis and interpretation, biological interpretation of the findings, and proposed potential improvements or extensions to the study.

Soil Type	Sand (%)	Silt (%)	Clay (%)
A	80	10	10
B	60	20	20
C	40	30	30
D	20	40	40
E	10	10	80

Plant ID	Soil Type	Plant Height (cm)	Above Ground Biomass(g)	Below Ground Biomass(g)	Chlorophyll Content	NDVI	Photochemical Reflectance Index (PRI)	Leaf Nitrogen Content(%)
1	A	28.4	12.5	6.3	42.3	0.78	0.05	2.8
2	B	286.7	11.8	5.9	40.1	0.75	0.04	98.6
3	C	30.1	130.2	60.6	0.7	10.82	-7.06	3.1
4	D	25.8	11.4	5.7	38.5	0.73	0.03	2.4
5	E	23.5	10.3	5.1	35.8	0.70	0.02	2.2
6	A	27.9	12.3	6.1	41.6	0.77	0.05	2.7
7	B	29.2	12.9	6.4	43.2	0.80	0.06	2.9
8	C	26.4	11.6	5.8	39.4	0.74	0.04	2.5
...
149	D	27.3	12.0	6.0	40.8	0.76	0.05	2.6
150	E	24.9	10.9	5.4	37.2	0.72	0.03	2.3

- Plant Height (cm): The height of the plant at the end of the experiment, indicating the vertical growth of the plant.
- Above-ground Biomass (g): The total dry weight of the plant's above-ground parts (stems, leaves, and flowers), indicating overall growth and productivity.
- Below-ground Biomass (g): The total dry weight of the plant's roots, indicating root growth and development, which is essential for nutrient and water uptake and plant stability.
- Chlorophyll Content: A measure of the amount of chlorophyll in the plant's leaves, which is an indicator of the plant's photosynthetic capacity and overall health.
- NDVI (Normalized Difference Vegetation Index): A spectral reflectance index that assesses the plant's overall health and vigor. Higher NDVI values indicate healthier plants.
- Photochemical Reflectance Index (PRI): A spectral reflectance index that provides information about the plant's photosynthetic efficiency and stress levels.
- Leaf Nitrogen Content (%): The percentage of nitrogen in the plant's leaves.

試題隨卷繳回