

國立成功大學

114學年度碩士班招生考試試題

編 號：233

系 所：經濟學系

科 目：統計學

日 期：0210

節 次：第 1 節

注 意：1.不可使用計算機
2.請於答案卷(卡)作答，於
試題上作答，不予計分。

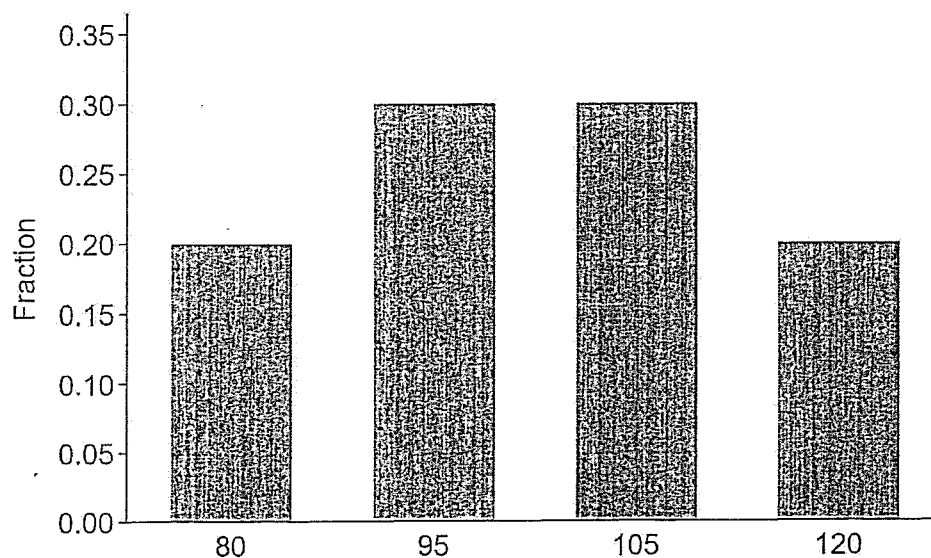
※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

※ **Instruction:** No point will be given if there is no explanation, no calculation, or if your answers are not understandable.

1. [30 points, 15 points each] As the lead researcher of a study comparing two weight-loss techniques—Diet and Exercise—you are investigating their effects on overweight patients [病人]. The table below presents the number of obese [過胖的] and severely obese [嚴重過胖的] individuals who successfully achieved significant weight loss (successes) and those who did not lose weight (failures) for each method.

	Diet		Exercise	
	Successes	Failures	Successes	Failures
Obese	10	30	22	58
Severely obese	60	20	35	5

- (a) Calculate the success rates of the two weight-loss techniques for *obese* and *severely obese*. What conclusions can be drawn about which technique works better?
- (b) Calculate the total success rates for both techniques and compare them. Are there any differences compared to part (a)? If so, explain the reason. If not, indicate which technique performs better.
2. [30 points] You operate a coffee shop where lattes are the primary product. The number of lattes sold each day varies and is independent of sales on other days. The distribution detailing your daily latte sales is shown below.



Assume latte sales are recorded over a period of 175 days. What is the approximate probability that the average number of lattes sold per day during this period exceeds 102?

3. [20 points, 10 points each] Generating two random variables that are positively correlated is often useful in stochastic simulations. One method for producing such correlated variables, x and y , involves calculating y as follows:

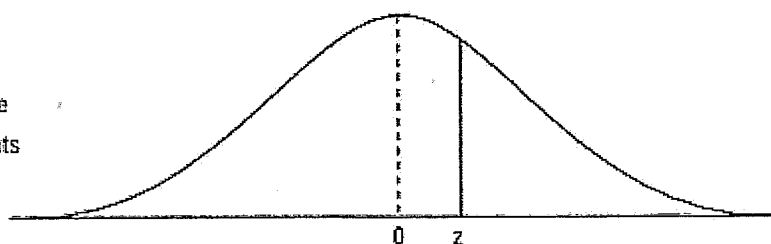
$$y = ax + b\varepsilon,$$

Here, x and ε are independent random variables, both with means of 0 and variances of 1, while a and b are constants.

- (a) Find the mean and variance of y in terms of a and b .
 - (b) Choose values for a and b such that the variance of y equals 2 and the correlation between x and y is 0.5. Provide all necessary calculations.
4. [20 points, 10 points each] Assume a set of observations $X_1, X_2, \dots, X_n$ that are iid, with a mean of θ and a known variance σ^2 . The mean θ is estimated using the following formula:

$$\hat{\theta} = \frac{X_1 + \dots + X_n}{n + 1}$$

- (a) Find the bias of this estimator, defined as $E(\hat{\theta}) - \theta$, in terms of n and θ . How does the bias behave as the sample size approaches infinity?
- (b) Find the mean squared error (MSE) for the estimator, given by $\text{Bias}^2 + \text{var}(\hat{\theta})$.

[illegible]