國立政治大學 114 學年度第 1 學期 期中考 考試命題紙

考試科目： 統計學 (一)　　開課班別： 統計學整合開課　　命題教授: 吳漢銘

考試日期：10/21(二)13:10-14:50	※准帶項目打「O」，否則打「×」					1. 需加發計算紙或答案紙請在試題內封袋備註。 2. 為環保節能減碳，試題一律採雙面印刷，有特殊印製需求，請註記：A 卷
本試題共3頁，印刷份數: 86 份	計算機	課本	筆記	字典	手機平板筆電	
備註：注意事項要看!! (ch1.1~5.5)	O	×	×	×	×	

注意事項:

(1) 在答題紙上填寫學號和姓名。請在答題紙右上角標明你使用的試卷編號：**A** (預設) 或 **B**。

(2) 所有問題可用中文或英文作答 (無需考慮語法和拼寫; 除非特別規定)。

(3) 請按題號順序作答。總分為 120 分。

(4) 建議使用深色原子筆 (允許使用鉛筆)。禁用手機 3C 產品。可使用計算機 (無程式功能)。

(5) 計算過程 (針對 **IV** 和 **V** 部分) 必須寫出 (計算至小數點後 4 位; 若答案包含有 $\log 5, e^3, 5!$ 等等式子，可直接寫，不需算出數字)。

(6) 答題紙、試題卷及計算紙須一併交回，不得攜出。

(7) 作弊學生當次及日後考試試卷將不予批改，情節嚴重將報校處理。

(-) 宣誓詞 (0%): 複寫下列宣誓詞至答案卷的第一頁上。(不寫扣 10 分)

0. " 本人姓名 恪遵各項考試規則，若如違反，願受校方最嚴厲處罰，謹誓。"

(I) 選擇題 (30%, 6% each); select one correct answer.

1. A student rolls a fair six-sided die. The face that lands on top shows a 4. Which of the following statements is correct? (A). The random variable is 4. (B). The random variable is the act of rolling the die. (C). The value 4 is a realization (or observed value) of the random variable "the result of the die roll." (D). The random variable is the set of possible outcomes {1, 2, 3, 4, 5, 6}.
2. The value of the sum of the deviations from the mean must always be (A). less than the zero. (B). negative. (C). either positive or negative depending on whether the mean is negative or positive. (D). zero.
3. Let A and B be two events with non-zero probabilities. Which of the following statements is always true? (A). If A and B are mutually exclusive, then they are independent. (B). If A and B are independent, then they are mutually exclusive. (C). If A and B are mutually exclusive, then $P(A \cap B) = 0$. (D). If A and B are independent, then $P(A \cup B) = P(A) + P(B)$.
4. Which of the following is not a property of a binomial experiment? (A). The experiment consists of a sequence of n identical trials. (B). Each outcome can be referred to as a success or a failure. (C). The probabilities of the two outcomes can not be changed from one trial to the next. (D). The experiments are independent.
5. A random variable W is found to have a variance of zero, $\text{Var}(W) = 0$. What is the correct interpretation of this result? (A). The expected value of W, $E(W)$, must be zero. (B). The random variable W can only take on a single, constant value. (C). The probability distribution of W is perfectly symmetric around its mean. (D). This is impossible; all random variables must have positive variance.

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(II) 填空題 (Correct spelling should be used.) (10%, 5% each)

6. The data in two or more crosstabulations are often combined or aggregated to produce a summary crosstabulation showing how two variables are related. The reversal of conclusions based on aggregate and unaggregated data is called _____.

7. When the data are believed to approximate a bell-shaped distribution, the empirical rule can be used to determine the percentage of data values that must be within a specified number of standard deviations of the mean. Approximately (____, ____, ____) of the data values will be within (one, two, three) standard deviation of the mean.

(III) 簡答題 (20%, 10% each)(write down the statement (or definition), formula if any, interpretation)

8. Based on th textbook, which graphical displays can be used to summarize data for two variables?

9. What is the definition of a continuous random variable? (答案禁止僅「英翻中」或僅寫「" 隨機變數是連續型的" 稱做連續型隨機變數」。)

(IV) 計算題 (40%, 20% each)

10. **Prostate Cancer Screening**. According to a 2018 article in Esquire magazine, approximately 70% of males over age 70 will develop cancerous cells in their prostate. Prostate cancer is second only to skin cancer as the most common form of cancer for males in the United States. One of the most common tests for the detection of prostate cancer is the prostate-specific antigen (PSA) test. However, this test is known to have a high false-positive rate (tests that come back positive for cancer when no cancer is present). Suppose there is a 0.02 probability that a male patient has prostate cancer before testing. The probability of a false-positive test is 0.75, and the probability of a false-negative (no indication of cancer when cancer is actually present) is 0.20.

    (a). What is the probability that the male patient has prostate cancer if the PSA test comes back positive?

    (b). What is the probability that the male patient has prostate cancer if the PSA test comes back negative?

11. **Introductory Statistics Course Withdrawals**. A university found that 20% of its students withdraw (棄修) without completing the introductory statistics course. Assume that 20 students registered for the course.

    (a). Compute the probability that 2 or fewer will withdraw.

    (b). Compute the probability that exactly 4 will withdraw.

    (c). Compute the probability that more than 3 will withdraw.

    (d). Compute the expected number and the variance of withdrawals.

    Binomial probability table for $n = 20$, $p = 0.2$:

x:	0	1	2	3	4	5	6	7	8	9	10	11	12+
$P(X = x)$:	.0115	.0576	.1369	.2054	.2182	.1746	.1091	.0545	.0222	.0074	.0020	.0005	.0000

(V) 加分題 (20%)

12. **Days Listed Until Sold**. Cooper Realty is a small real estate company located in Albany, New York, specializing primarily in residential listings. They recently became interested in determining the likelihood of one of their listings being sold within a certain number of days. An analysis of company sales of 800 homes in previous years produced the following data. If A is defined as the event that a home is listed for more than 90 days before being sold. If B is defined as the event that the initial asking price is under $150,000. Are events A and B independent?

		Days Listed Until Sold		
		Under 30	31–90	Over 90
Initial Asking Price	Under $150,000	50	40	10
	$150,000–$199,999	20	150	80
	$200,000–$250,000	20	280	100
	Over $250,000	10	30	10