

第一部分為選擇題，答案請填於答案卡上

第二部分為計算說明題，答案請寫於答案卷上，需列計算過程，否則不予計分

第一部分：選擇題，共二十五題，每題兩分。

Please read the following paragraph and answer the subsequent 7 questions.

The marketing VP of Playstation is pondering the global pricing decision for the upcoming gear, Playstation VR (PSVR). The early discussion among top managers speculated that the market price of PSVR would better to be very close to the price of Playstation, \$349, to make the profit. In order to examine whether the potential customers in the global market expect the similar price tag, a market research firm is contracted to conduct the survey. After collecting 634 responses from Playstation fans on Twitter in a handful of countries, the initial analysis result shows that survey participants' average expected price of PSVR is \$268.

1. Which of the following would be an appropriate null hypothesis for the marketing VP of Playstation?
  - A. The mean expected price of PSVR in the global market is not less than \$268.
  - B. The mean expected price of PSVR for Twitters users is not less than \$268.
  - C. The mean expected price of PSVR in the global market is not greater than \$349.
  - D. The mean expected price of PSVR for Twitters users is not greater than \$349.
2. The marketing VP's null hypothesis would be rejected if a \_\_\_ probability of committing a Type I error is allowed.
  - A. 5%
  - B. 10%
  - C. 20%
  - D. none of the above
3. Which of the following best describes the Type I error?
  - A. The marketing VP of Playstation concludes that the mean expected price of PSVR is greater than \$349 when it is in fact not greater.
  - B. The marketing VP of Playstation concludes that the mean expected price of PSVR is lower than \$349 when it is in fact not lower.
  - C. The marketing VP of Playstation concludes that the mean expected price of PSVR is greater than \$268 when it is in fact not greater.
  - D. The marketing VP of Playstation concludes that the mean expected price of PSVR is lower than \$268 when it is in fact not lower.
4. Which of the following best describes the Type II error?
  - A. The marketing VP of Playstation concludes that the mean expected price of PSVR is not greater than \$349 when it is in fact greater.
  - B. The marketing VP of Playstation concludes that the mean expected price of PSVR is not lower than \$349 when it is in fact lower.
  - C. The marketing VP of Playstation concludes that the mean expected price of PSVR is not greater than \$268 when it is in fact greater.
  - D. The marketing VP of Playstation concludes that the mean expected price of PSVR is not lower than \$268 when it is in fact lower.
5. Assume that prior to the survey, researchers at the market research firm speculated that the mean expected price of PSVR would be lower than \$280. If the survey result shows that the probability to conclude that the mean

見背面

- expected price of PSVR is not lower than 280 when it is in fact lower is .16, what is the probability to conclude that the mean expected price of PSVR is lower than 280 when it is in fact not lower?
- A. .84  
B. .16  
C. the level of significance  
D. the standard deviation divided by the sample size
6. Following the above question, what is the probability to reject the null hypothesis that mean expected price of PSVR is not lower than 280 when it is in fact lower?
- A. .84  
B. .16  
C. the level of significance  
D. the standard deviation divided by the sample size
7. Following the above two questions, if the  $p$ -value is .064, what is the probability not to reject the null hypothesis that mean expected price of PSVR is not lower than 280 when it is in fact not lower?
- A. .936  
B.  $1 - \text{the level of significance}$   
C. .84  
D.  $1 - \text{the standard deviation divided by the sample size}$
8. The marketing VP of Playstation would like to know whether the exposure of PSVR commercial which demonstrates the unique features and game application (differential from Oculus's Rift and HTC's vive) would make any change on customers' expected price of PSVR. 30 potential customers were asked to provide their initial perceptions of expected price on PSVR. Four weeks later, the same group of customers were asked to view the PSVR commercial and then provide their perceptions of expected price on PSVR. Therefore, two datasets, one without and the other with previously exposing to the PSVR commercial, were collected. In order to examine the effect of commercial exposure on expected price, which test would likely be most appropriate to employ?
- A. Pooled-variance  $t$  test for the difference between two means  
B. Paired  $t$  test  
C.  $F$  test for the ratio of two variances  
D. Separate-variance  $t$  test for the difference between two means
9. Following the above question, the degree of freedom in the test is \_\_\_\_.
- A. 58  
B. 29  
C. 29, 29  
D. 59
10. Following the above two questions, if the  $p$ -value in the test was .02 and the significance level was at .05, which of the following is correct?
- A. there is not a significant change in the expected price  
B. The effect of commercial exposure on expected price would be dependent on the power of the test.  
C. The effect of commercial exposure on expected price is significant.  
D. The effect of commercial exposure on expected price is significant only when the Type I error is lower than .05.

The marketing VP of Playstation would like to identify potential variables which may account for the sales volume of PSVR. Five cities, Pittsburgh, Halifax, Darwin, Bristol, and Cologne with similar sales of Playstation are selected. The unit sales of Playstation in the last quarter was 1154, 1155, 1157, 1160, and 1159, respectively. And the promotion budget was \$14520, \$14500, \$14460, \$14400, \$14420, respectively. The expected sales of PSVR is

$S_i, S_i \neq 0, i = 1$  to 5. The marketing VP of Playstation runs two regressions. In the first regression, the expected sales of PSVR serves as the dependent variable and the unit sales of Playstation in the last quarter serves as the independent variable. In the second regression, the same dependent variable is used but the independent variable is switched to the promotion budget. Please answer the following 7 questions.

11. Which of the following is correct about R-square?
  - A. To compare R-squares in two regressions,  $S_i, i = 1$  to 5, needs to be specified.
  - B. R-squares in two regressions must be different.
  - C. R-squares in two regressions must be identical.
  - D. The summation of R-squares must be equal to 1.
12. Which of the following is correct about the standardized coefficient of regression?
  - A. To compare standardized coefficients of regression in two regressions,  $S_i, i = 1$  to 5, needs to be specified.
  - B. Standardized coefficients of regression in two regressions must be different in magnitude.
  - C. Standardized coefficients of regression in two regressions must be identical in magnitude but opposite in valence.
  - D. The sum of standardized coefficients of regression in two regressions must be equal to 1.
13. Which of the following is correct about the coefficient of regression (of independent variable)?
  - A. To compare coefficients of regression in two regressions,  $S_i, i = 1$  to 5, needs to be specified.
  - B. Coefficients of regression in two regressions must be different in magnitude but identical in valence.
  - C. Coefficients of regression in two regressions must be identical in magnitude but opposite in valence.
  - D. The sum of coefficients of regression in two regressions must be equal to 1.
14. The intern assistant of marketing VP attempts to fumble with the data. Two new variables are created. One is the summation of unit sales and promotion budget. The other is the subtraction of promotion budget from unit sales. Two more regression models are created with only one new created variable serving as the independent variable. Dependent variable is still the same. In each regression model, only one independent variable is included. Now, the intern gets four regression models on hand. In these four regression models, unit sales, promotion budget, summation of unit sales and promotion budget, and subtraction of promotion budget from unit sales serve as independent variable in the first to the fourth regression model, respectively. Which of the following is correct about R-square?
  - A. To compare R-squares in Four regressions,  $S_i, i = 1$  to 5, needs to be specified.
  - B. R-squares in four regressions must be different.
  - C. R-squares in four regressions must be identical.
  - D. The summation of R-squares must be equal to 2.
15. Which of the following is correct about the standardized coefficient of regression?
  - A. To compare standardized coefficients of regression in four regressions,  $S_i, i = 1$  to 5, needs to be specified.
  - B. Standardized coefficients of regression in the last two regressions must be identical.
  - C. Standardized coefficients of regression in the last two regressions must be identical in magnitude but opposite in valence.
  - D. The sum of standardized coefficients of regression in the last two regressions must be equal to 1.
16. Which of the following is correct about the standardized coefficient of regression?
  - A. The standardized coefficient of regression in the 1<sup>st</sup> regression model is different from the standardized coefficient of regression in the 4<sup>th</sup> regression model.
  - B. The standardized coefficient of regression in the 1<sup>st</sup> regression model is identical to the standardized coefficient of regression in the 2<sup>nd</sup> regression model.
  - C. The standardized coefficient of regression in the 3<sup>rd</sup> regression model is identical to the standardized coefficient of regression in the 4<sup>th</sup> regression model.
  - D. The standardized coefficient of regression in the 3<sup>rd</sup> regression model is identical to the standardized coefficient of regression in the 2<sup>nd</sup> regression model.

見背面

17. Which of the following is correct about  $p$ -value of independent variable?
- The  $p$ -value of independent variable in the 3<sup>rd</sup> regression model is different from the  $p$ -value in the 4<sup>th</sup> regression model.
  - The  $p$ -value of independent variable in the 3<sup>rd</sup> regression model is identical to the  $p$ -value in the 4<sup>th</sup> regression model, but different from the  $p$ -value in the 2<sup>nd</sup> regression model.
  - The  $p$ -values of independent variable in four regressions must be different.
  - The  $p$ -values of independent variable in four regressions must be identical.
18. When fumbling with the survey data, the intern exacts the survey data from 20 randomly selected cities, and notices that in these 20 cities, expected sales is a function of promotion budget. That is, (expected sales) =  $f$  (promotion budget). Which of the following is correct?
- The correlation coefficient between expected sales and promotion budget is equal to 1.
  - The correlation coefficient between expected sales and promotion budget can be 0.
  - In the regression with expected sales serving as dependent variable and promotion budget serving as independent variable, the standardized coefficient of regression is equal to 1 or -1.
  - The correlation coefficient between expected sales and promotion budget must be positive.

The intern creates a one-way ANOVA table out of the survey data as follows. In this analysis, four types of commercials are employed in 32 cities to examine the commercial effect on the expected purchase units of PSVR. Each type of commercial is tested in eight cities. Please answer the following 6 questions.

Source	df	SS	MS	F	p
Type of Commercial	A	D	38	2	.075
Error	B	532	E		
Total	C	F			

19. What is the value of A?
- 3
  - 4
  - 7
  - 8
20. What is the value of B?
- 27
  - 28
  - 29
  - 31
21. What is the value of C?
- 30
  - 31
  - 32
  - 33
22. What is the value of D?
- 81
  - 108
  - 114
  - 124

接次頁

23. What is the value of E?  
A. 31.29  
B. 17.16  
C. 16.625  
D. 19
24. What is the value of F?  
A. 613  
B. 640  
C. 646  
D. 656
25. Which of the following statement is correct?  
A. In the two-tail Chi-square test, the null hypothesis would be rejected if the negative test statistic is lower than the negative critical value.  
B. In the one-way ANOVA, when population means are all the same,  $F$ -value from sampling will be very small.  
C.  $F$ -value in the one-way ANOVA may be negative.  
D. When examining mean difference between two groups,  $p$ -value in an independent sample  $t$ -test is identical to  $p$ -value in a one-way ANOVA.

第二部份：計算說明題，共四題，每題分數標示於該題前。

- (15分) 26. 日前新聞報導，兩位同名同姓的張姓女子透過不同的電商平台網購不同商品，不約而同都指定同一家超商取貨，但兩件商品都被先到的張姓女子領走，以至於後到的另一位張姓女子撲空。請問，如何估計「兩個同名同姓的人在不同網站購物又指定同一地點取貨且先到的人同時領走兩件商品」這件事的機率？請以分解法說明你/妳的估計模式。
- (10分) 27. 所得程度與健康狀況有什麼關聯性？為了探討此問題，統計學家針對一群心臟病人進行抽樣。每一個人被歸類為低所得、中所得、或高所得。每一個人也被歸類成存活或死亡。一位統計學家表示，在我們的社會中有 31% 落在低所得群，49% 是在中所得群，以及 20% 是在高所得群。另一份對心臟病人的分析顯示，7% 的低所得民眾、9% 的中所得民眾、13% 的高所得民眾死於心臟病。請問，一位心臟病存活者是屬於低所得群的機率是多少？
- (10分) 28. 開車時使用手機到底有無危險一直是很多研究人員關注的議題。最近的研究似乎指出危險性相當高，原因是講電話時，駕駛人的反應時間可能變慢。某大學的研究人員對擁有手機的駕駛人進行抽樣實驗，測量其反應的時間。半數的樣本檢測其講電話時的反應，另外半數的樣本檢測其沒有講電話時的反應。樣本統記量摘要如下。我們如何透過此樣本來分析使用手機駕駛人的反應時間，是否確實變得比較慢？

	樣本平均數	樣本標準差	樣本數
講電話時	0.646	0.045	125
沒有講電話時	0.601	0.053	145

- (15分) 29. 出這份考題的統計學教授批閱一份考卷所花的時間是一具有平均數 3.6 分鐘與標準差 1.6 分鐘的常態分佈。已知總應考人數為八百人。從過去歷史資料估計缺考率約為 12%。倘若這位教授每天花八小時來閱卷，請問他/她必須至少花五天的機率是多少？倘若開放閱卷的天數就只有五天，這位教授應該怎麼辦？

(第二部分計算說明題的答案，請寫於答案卷上)

見背面

Standard Normal Cumulative Probability Table

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

試題隨卷繳回