一、選擇題(每題2%，共34%)

1. Which distribution is used in testing the hypotheses about the equality of two population variances?
   (A) z-distribution　　(B) t-distribution　　(C) x^2 distribution　　(D) F-distribution

2. When a hypothesis test is to be conducted regarding a population variance, the test statistic will be:
   (A) a x^2 value from the chi-square distribution.
   (B) a z-value from the standard normal distribution.
   (C) a t-value from the t-distribution.
   (D) a binomial distribution p value.

3. The correlation coefficient
   (A) lies between zero and one.
   (B) takes on a high value if you have a strong nonlinear relationship.
   (C) is a measure of linear association.
   (D) is close to one if *X* causes *Y*.

4. A large retail company gives an employment screening test to all prospective employees. If a prospective employee receives a report saying that she scored at the 40th percentile:
   (A) she scored better than 40 percent of people who took the test.
   (B) she scored above the median.
   (C) her z-score was a 40.
   (D) she scored in the top 40 percent of people who took the test.

5. When testing the null hypothesis that two regression slopes are zero simultaneously, then you cannot reject the null hypothesis at the 5% level, if the ellipse contains the point
   (A) $(1.96^2, 1.96^2)$.　　(B) (-1.96, 1.96).　　(C) (0,0).　　(D) $(0, 1.96)$.

6. The overall regression *F*-statistic tests the null hypothesis that
   (A) the intercept in the regression and at least one, but not all, of the slope coefficients is zero.
   (B) the slope coefficient of the variable of interest is zero, but that the other slope coefficients are not.
   (C) all slope coefficients and the intercept are zero.
   (D) all slope coefficients are zero.

7. A major retail store has studied customer behavior and found that the distribution of time customers spend in a store per visit is symmetric with a mean equal to 17.3 minutes. Based on this information, which of the following is true?
   (A) The median is to the right of the mean.　　(B) The distribution is bell-shaped.
   (C) The median is approximately 17.3 minutes.　　(D) The median is to the left of the mean.

8. Which of the following will increase the width of a confidence interval (assuming that everything else remains constant)?
   (A) Decreasing the confidence level　　(B) A decrease in the standard deviation
   (C) Increasing the sample size　　(D) Decreasing the sample size

Use the following regression results to answer the question 9 and question 10.

Regression Statistics	
Multiple R	0.8851
R Square	0.7835
Adjusted R Square	0.7474
Standard Error	5.4006
Observations	8

ANOVA

	df	SS	MS	F
Regression	1	633.242	633.242	21.711
Residual	6	175.000	29.167	
Total	7	808.242		

	Coefficients	Standard Error	t Stat	P–value
Intercept	5.93118	4.17721	1.41989	0.20545
Total Bill	–2.71551	0.58279	–4.65952	0.00347

9. Which of the following is true?
   (A) x explains about 88.5 percent of the variation in y.
   (B) y explains about 88.5 percent of the variation in x.
   (C) y explains about 78.4 percent of the variation in x.
   (D) x explains about 78.4 percent of the variation in y.

10. In conducting a hypothesis test of the slope using a 0.05 level of significance, which of the following is correct?
   (A) The slope differs significantly from 0 because p = 0.003 is less then 0.05.
   (B) The slope does not differ significantly from 0 because p = 0.205 is greater then 0.05.
   (C) The slope differs significantly from 0 because p = 0.205 is greater then 0.05.
   (D) The slope does not differ significantly from 0 because p = 0.003 is less then 0.05.

Consider the following partially completed computer printout for a regression analysis where the dependent variable is the price of a personal computer and the independent variable is the size of the hard drive. Based on the information provided, please answer the question 11 to question 14.

SUMMARY OUTPUT					
Regression Statistics					
Multiple R	0.819361805				
R Square					
Adjusted R Square	0.661687702				
Standard Error					
Observations	36				
ANOVA					
	df	SS	MS	F	Significance F
Regression	1	33116034.84	33116034.84		
Residual		16211214.72			
Total	35	49327249.56			
	Coefficients	Standard Error	t Stat	P-value	
Intercept	50.84102383	246.9869514	0.205844979	0.838139607	
Hard Drive Capacity	217.7539792	26.12854674		9.95844E-10	

11. Based on the information provided, what percentage of the variation in the price of the personal computers is accounted for by the regression model using hard drive capacity as the independent variable?
    (A) About 66 percent　　　　(B)217.75　　　　(C) About 82 percent　　　　(D)About 67 percent

12. Based on the information provided, what is the estimate for the standard error of the estimate for the regression model?
    (A) Just under 376.23　　　　　　　　　(B) Approximately 690.50
    (C) 476,800　　　　　　　　　　　　　(D) About 4,026

13. Based on the information provided, what is the F statistic?
    (A) Just over 2.35　　　(B) About 4.76　　　(C) About 8 .33　　　(D) About 69.5

14. Based on the information provided, which of the following statements is true if alpha = .05?
    (A) The slope is not significantly different from 0 because p = 0.84 is greater than 0.05.
    (B) The slope is significantly different from 0 because p = 9.95E-10 is less than 0.05.
    (C) The slope is not significantly different from 0 because p = 9.95 is greater than 0.05.
    (D) The slope is significantly different from 0 because p = 9.95 is greater than 0.05.

A two-factor analysis of variance is conducted to test the effect the price and advertising have on sales of a particular brand of bottled water. Each week a combination of particular levels of price and advertising are used and the sales level is recorded. The computer results are shown below. Use the results to answer the question 15 to question 17.

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Sample (advertising)	99.73324	1	99.73324	5.251652	0.034201	4.413873
Columns (price)	1150.432	2	575.2161	30.28914	1.74E-06	3.554557
Interaction	1577.526	2	788.7629	41.53387	1.8E-07	3.554557
Within	341.835	18	18.99083			
Total	3169.526	23				

15. How many replications were used in this study?
    (A) 2　　　　　　　　(B) 5　　　　　　　　(C) 4　　　　　　　　(D) 3

16. Based on the results above, which of the following is correct?
    (A) 3 levels of adverting and 2 levels of price were used.
    (B) There were a total of 6 different treatments.
    (C) 1 level of advertising and 2 levels of price were used.
    (D) 2 levels of advertising and 3 levels of price were used.

17. Based on the results above and a 0.05 level of significance, which of the following is correct?
    (A) There is no interaction between price and advertising, and both factors significantly affect sales
    (B) There is interaction between price and advertising, so the above results for individual factors may be misleading
    (C) There is interaction between price and advertising, so the above results conclusively show that both factors affect price
    (D) There is no interaction between price and advertising, so results for individual factors may be misleading

二、　某銀行為了提升服務效率，不斷更新資訊系統與重新設計新的電話客服作業程序，但卻使得客服人員抱怨連連。在以往的電話客服流程下，每位電話客服人員平均每天可服務100人，但引入新系統與實施新作業程序後，隨機抽取100位電話客服專員，卻發現每人每天的平均客服完成人數為96人，標準差為20。請問：

(1) 在顯著水準0.05的情況下，新的電話客服系統與制度是否提升客服人員工作績效？(4%)

(2) 假如希望能將型II誤差(Type II error)定為0.06，則顯著水準應該設定為多少？(4%)

(3) 若希望型I與型II誤差皆等於0.10，則須選取幾位客服人員的資料？(4%)

($Z_{\alpha=.1}=1.28$；$Z_{\alpha=.05}=1.645$；$Z_{\alpha=.025}=1.96$；$Z_{\alpha=.01}=2.33$　；$Z_{\alpha=.0025}=2.825$)

三、　有 100 人同時報考央大與山大的人資所，其中有 48 人被兩所錄取，有 12 人只被央大錄取，有 5 人只被山大錄取，有 35 人兩間學校都沒有錄取。如果顯著水準是 0.05，請問兩間學校的錄取率是否有所差異？(4%)($Z_{\alpha=.1}=1.28$；$Z_{\alpha=.05}=1.645$；$Z_{\alpha=.025}=1.96$；$Z_{\alpha=.01}=2.33$　；$Z_{\alpha=.0025}=2.825$)

四、計算題(每題 10%，共 50%)：

1. The distribution of resistance of resistors of a certain type is known to be normal, with 2.5% of all resistors having a resistance exceeding 15 ohms, and 5% having a resistance smaller than 10 ohms. What are the mean value and standard deviation of the resistance distribution?

2. Let X be the number of the customers to arrive the NKK bank within one hour. Suppose the X follows a Poisson probability distribution with mean $\lambda = 120$ (in minutes). What is the probability at least three customers to arrive the NKK bank between AM 11:00 and AM 11:20.

3. In commuting to work, Tom must first get on a bus near his house and then transfer a second bus. If the waiting time (in minutes) at each stop is independent and has a uniform distribution U(0, 5). What is the cumulative distribution function of the total waiting time?

4. NKK Milk Company wants an estimate of the proportion of the population that uses its brand. The company wants the estimate correct within 1% at the 99% confidence level. How big a sample should it select?

5. After running a multiple regression analysis with four independent variables, the following ANOVA table is obtained. What is the value of (a)~(f) and R^2.

Source	d.f.	SS	MS	F
Regression	(a)	(c)	50	(f)
Residual	(b)	(d)	(e)	
Total	45	270		

常態分配表										
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990
3.1	0.4990	0.4991	0.4991	0.4991	0.4992	0.4992	0.4992	0.4992	0.4993	0.4993
3.2	0.4993	0.4993	0.4994	0.4994	0.4994	0.4994	0.4994	0.4995	0.4995	0.4995
3.3	0.4995	0.4995	0.4995	0.4996	0.4996	0.4996	0.4996	0.4996	0.4996	0.4997
3.4	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4997	0.4998
3.5	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998	0.4998