PART I. Multiple Choice Questions, 3 points each. You do not need to show detailed steps，無需列出計算過程。

1. A coffee company begins to sell a new product. Managers know the probability the product will be profitable is 20%. They also know from previous market research that when the product is profitable, there is 60% chance that their test panel liked the product and that when it is unprofitable; there is 95% chance that the panel did not like it. The probability (p) that the product is profitable given the test panel liked is. .

   A) $0.4 < p < 0.5$　　B) $0.5 < p < 0.6$　　C) $0.6 < p < 0.7$　　D) $0.7 < p < 0.8$.

2. Of 7 financial analysts, 3 are pessimistic about the future stock market. A newspaper reporter interviews two of the 7 analysts. What is the probability that one of the interviewees takes an optimistic view and the other take a pessimistic view?

   A) $0.4 < p < 0.5$　　B) $0.5 < p < 0.6$　　C) $0.6 < p < 0.7$　　D) $0.7 < p < 0.8$.

3. The number of phone calls that reach 1-800 in a certain time period follow a Poisson distribution. Assume that there are 8000 potential callers. Each caller has a probability of 0.002 of making such a phone call. Use normal approximation to find the probability that we have less than 20 callers making the call during this time period.

   A) $0.6 < p < 0.7$　　B) $0.7 < p < 0.8$　　C) $0.8 < p < 0.9$　　D) $0.9 < p < 1$.

4. Toss a die 12 times. Let X denotes the counted number that the die shows number "1" in the experiment.

   Using the Chebyshev inequality ($P(|X - \mu| \le k\sigma) \ge 1 - \dfrac{1}{k^2}$) to find the lower bound of $P(0 \le X \le 4)$

   A) $0.4 < p < 0.5$　　B) $0.5 < p < 0.6$　　C) $0.6 < p < 0.7$　　D) $0.7 < p < 0.8$.

5. It is known that the probability that banks go bankruptcy within one year during the financial crisis is 0.2. There are 36 banks in the market. Using Normal Approximation to find that probability (p) that there are less than 5 banks going bankruptcy within one year

   A) $0.1 < p < 0.2$　　B) $0.2 < p < 0.3$　　C) $0.3 < p < 0.4$　　D) $0.4 < p < 0.5$.

6. A magazine company surveys the age of their readers and find the average age is 35 years old. It is know that population standard deviation is 6. Based upon a sample of 25 readers, using Chebyshev inequality

   ($P(|\bar{X} - \mu| \le k\sigma_{\bar{x}}) \ge 1 - \dfrac{1}{k^2}$) to find the 96% confidence interval which is close to which of the following

   A) [29, 41]　　B) [30, 40]　　C) [31, 39]　　D) [32, 38]　　E) [33, 37]

7. An automobile manufacturer claims that a new car can get an average of 35 miles per gallon. Assume that the distribution is normal with a standard deviation of 3.2 miles per gallon. A random sample of 16 cars gives an average of 36 mile per gallon. The alternative hypothesis is the population mean is more than 35 miles per gallon. What is the p value of this test

   A) $p < 0.01$　　B) $0.01 < p < 0.025$　　C) $0.025 < p < 0.05$　　D) $0.05 < p < 0.1$　　E) $0.1 < p$.

8. The government likes to know if there are over 50% of country citizens supporting its nuclear power policy. The government surveys a sample of 100 citizens. The decision rule is that rejecting the null hypothesis if there are less than 42 citizens of the sample supporting the policy. What is the probability of Type I error (α)

    A) $\alpha<0.01$ B) $0.01<\alpha<0.025$ C) $0.025<\alpha<0.05$ D) $0.05<\alpha<0.1$ E) $0.1<\alpha$.

9. Following the question 8, if the true ratio that citizens support the policy is known as 40%. Find the probability of Type II error (β)

    A) $\beta<0.2$ B) $0.2<\beta<0.3$ C) $0.3<\beta<0.4$ D) $0.4<\beta<0.5$.   E) $0.5<\beta$.

10. The continuous variable X follows the Uniform distribution $f(x)=\dfrac{1}{\theta},0<x<\theta$. To test

$H_0:\theta=1$ vs. $H_1:\theta=2$, observe one sample and let $x>0.8$ be the rejection region. Find the probability of

Type II error (β)

    A) $\beta=0.2$ B) $\beta=0.4$ C) $\beta=0.6$ D) $\beta=0.8$ E) $\beta=1.2$

11. The business manager of a local health clinic is interested in estimating the difference between the fees for extended office visits in her center and the fees of a newly opened group practice. She gathered the following information regarding the two offices.

	Health Clinic	Group Practice
Sample size	50 visits	45 visits
Sample mean	$21	$19
Standard deviation	$2.75	$3.00

Develop a 95% confidence interval estimate for the difference between the average fees of the two offices.

    A) 0.8383 to 3.1617   B) 0.5124 to 2.5414   C) 0.1223 to 1.5421   D) 0.9811 to 4.5748

12. An insurance company selected samples of clients under 18 years of age and over 18 and recorded the number of accidents they had in the previous year. The results are shown below.

Under Age of 18	Over Age of 18
$n_1=500$	$n_2=600$
Number of accidents = 180	Number of accidents = 150

We are interested in determining if the accident proportions differ between the two age groups. Compute the test statistic.

    A) 0.96   B) 2.96   C) 1.96   D) 3.96

13. The daily production rates for a sample of factory workers before and after a training program are shown below.

Worker	Before	After
1	6	9
2	10	12
3	9	10
4	8	11
5	7	9

We want to determine if the training program was effective. Compute the test statistic.

A) 5.88 B) 6.25 C) 2.13 D) 4.33

14. A sample of 41 observations yielded a sample standard deviation of 5. If we want to test H_0: $\sigma^2 = 20$, the test statistic is

A) 100 B) 20 C) 40 D) 50

15. In order to determine whether or not a particular medication was effective in curing the common cold, one group of patients was given the medication, while another group received sugar pills. The results of the study are shown below.

	Patients Cured	Patients Not Cured
Received medication	70	10
Received sugar pills	20	50

We are interested in determining whether or not the medication was effective in curing the common cold. The test statistic is

A) 35.96 B) 54.02 C) 44.64 D) 25.63

16. The table below gives beverage preferences for random samples of teens and adults.

	Teens	Adults	Total
Coffee	50	200	250
Tea	100	150	250
Soft Drink	200	200	400
Other	50	50	100
Total	400	600	1,000

We are asked to test for independence between age (i.e., adult and teen) and drink preferences. The test statistic is

A) 54.6 B) 62.5 C) 71.5 D) 53.2

17. To test whether or not there is a difference between treatments A, B, and C, a sample of 12 observations has been randomly assigned to the 3 treatments. You are given the results below.

Treatment	Observation			
A	20	30	25	33
B	22	26	20	28
C	40	30	28	22

The mean square between treatments (MSTR) equals

A) 26　　B) 46　　　C) 36　　　D) 56

18. In a regression analysis, the regression equation is given by $y = 12 - 6x$. If SSE = 510 and SST = 1000, then the coefficient of correlation is

A) -0.5　　B) 0.5　　C) -0.7　　D)　0.7

19. The following information regarding a dependent variable Y and an independent variable X is provided.

$X = 90$　　　　　　$(Y - \bar{Y})(X - \bar{X}) = 466$

$Y = 170$　　　　　　$(X - \bar{X})^2 = 234$

$n = 10$　　　　　　$(Y - \bar{Y})^2 = 1434$

$SSE = 505.98$

The slope of the regression function is

A) 0.923　　B) 0.871　　C) 1.991　　D) 2.425

20. Below you are given a partial computer output based on a sample of 12 observations relating the number of personal computers sold by a computer shop per month (Y), unit price (X_1 in \$1,000) and the number of advertising spots (X_2) they used on a local television station.

	DF	SS	MS	F	Significance F
Regression	2	655.955			
Residual	9				
Total		838.917			

Determine the adjusted multiple coefficient of determination.

A) 0.734　　B) 0.612　　C)　0.782　　D)　0.648

PART II. You <u>must show detailed steps</u> for each question to get credits. (需列出計算過程才能獲得分數).

1. (8%) The joint distribution of random variable X and Y is $f(x, y) = k(x + y)$, x=0,1,2，y=1,2。 (a). find k, (b). find the conditional probability $f(x|y)$

2. (12 points) A random sample $X_1, X_2, ..., X_{18}$ is obtained from the population with $p.d.f$.

   $f(x) = 1 - \dfrac{x}{2}, 0 \le x \le 2$. Let $Y = X_1 + X_2 + ... + X_{18}$, using Normal Approximation to estimate the

   probability $P(12 \le Y \le 15)$

3. (10 points) Assume you have noted the following prices for books and the number of pages that each book contains.

Book	Pages (x)	Price (y)
A	500	$7.00
B	700	7.50
C	750	9.00
D	590	6.50
E	540	7.50
F	650	7.00
G	480	4.50

   (a) What is the least-squares estimated regression line?
   (b) Calculate the F statistic for the test of the relation between the pages (x) and the price (y).

4. (10 points) The marketing department of a company has designed three different boxes for its product. It wants to determine which box will produce the largest amount of sales. Each box will be test marketed in five different stores for a period of a month. Below you are given the information on sales.

	Store 1	Store 2	Store 3	Store 4	Store 5	Total
Box 1	210	230	190	180	190	1000
Box 2	195	170	200	190	193	948
Box 3	295	275	290	275	265	1400
Total	700	675	680	645	648	3348

   (a) Compute the sum of squares due to blocks.
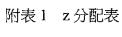   (b) What is the degree of freedom for the sum of squares due to error?

附表 1　z 分配表

P(0<Z<z)=α

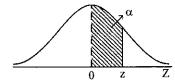| z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	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