



1. The Worldinvest Co. is ready to invest 22 million U.S. dollars in Japan (Yen) and 10 million U.S. dollars in Malaysia (Ringgit). Moreover, finding an effective method to convert U.S. dollars into Yen and Ringgit is a critical problem for managers. Table 1 states currency transaction rates, and Table 2 shows the transaction limits allowed by the Worldinvest Co. Note that exchange rates are ignored.

Table 1: Currency transaction cost, percent

From	To				
	U.S. dollar	Euro	Rupiah	Yen	Ringgit
U.S. dollar	-	1.5	1.1	-	-
Euro	-	-	0.5	0.5	1
Rupiah	-	-	-	0.4	0.5
Yen	-	-	-	-	2
Ringgit	-	-	-	1.4	-

"-" represents disallowed transaction.

Table 2: Transaction limits in equivalent of 1,000 U.S. dollars

From	To				
	U.S. dollar	Euro	Rupiah	Yen	Ringgit
U.S. dollar	-	2500	1200	-	-
Euro	-	-	$\infty$	3000	2000
Rupiah	-	-	-	1200	$\infty$
Yen	-	-	-	-	$\infty$
Ringgit	-	-	-	$\infty$	-

"-" represents disallowed transaction.

- (a) Formulate a network problem for finding an effective method to convert U.S. dollars into Yen and Ringgit (10%), and draw the corresponding network graph (clearly identify the supply and demand nodes and indicate the information of Tables 1 and 2 in the graph, 5%).
- (b) Find the optimal solution and how many transaction cost does the Worldinvest Co. have to pay at least(10%)?



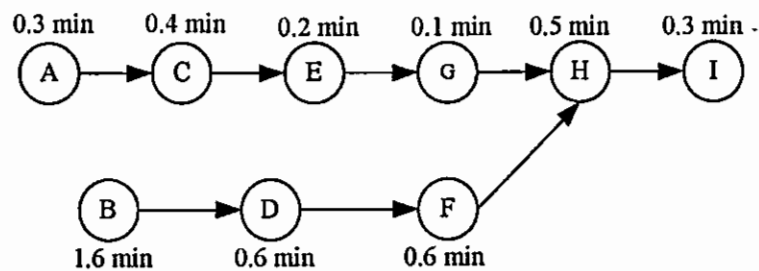
2. A company sells three products,  $P_1$  for \$2,  $P_2$  for \$1, and  $P_3$  for \$1. The sales of  $P_1$  needs one unit resource 1 and one unit resource 3, sales of  $P_2$  needs one unit resource 2 and one unit resource 3, and sales of  $P_3$  needs one unit resource 1 and one unit resource 2. Now, the company has resource 1 with one unit, resource 2 with two units, and resource 3 with three units. The company's problem is focused on maximizing the income.
- Formulate the LP model of this problem (5%) and the dual to this LP (5%).
  - Show that using up all the resources is an optimal policy by fundamental insight (5%), and find the optimal solution of the dual problem when using up the resources (5%).
  - If the company expands all the resources by  $k$  times while using up them, explain the relationship between the new optimal solution and the solution of part (b) regarding the primal problem (5%).
3. Assume that weather of each day can be classified as Not rainy (N) and Rainy (R). Let  $X_n$  be the weather of day  $n$ . Assume that  $\{X_n, n = 1, 2, \dots\}$  is a Markov chain (i.e., weather of day  $n+1$ ,  $X_{n+1}$ , depends on weather of day  $n$ ,  $X_n$  only) with the following transition probabilities:  $P_{NN} = 0.7$ ,  $P_{RR} = 0.4$ . There is a fresh bread seller who brings 10 units of bread to the market to sell each day. The unsold bread is discarded at the end of each day. The demand of bread each day is either 8 or 10 or 12 units and depends on the weather of that day with the following structure:
- If the weather is N then with probability 0.5 the demand of bread is 8 and with probability 0.5 the demand of bread is 10.
  - If the weather is R then with probability 0.8 the demand of bread is 10 and with probability 0.2 the demand of bread is 12.
- Find the expected number of discarded bread loaves per day (15%)
  - Find the expected number of unmet demand per day (15%)



4. In the last problem we assume that weather of day  $n+1$ ,  $X_{n+1}$  depends on  $X_n$  only. This assumption does not hold in general. Let us relax this assumption and assume that  $X_{n+1}$  depends on  $X_n$  and  $X_{n-1}$ . Thus  $\{X_n, n = 1, 2, \dots\}$  is not a Markov chain.
- (a) How do you transform  $\{X_n, n = 1, 2, \dots\}$  into a Markov chain  $\{Z_n, n = 1, 2, \dots\}$ ? What is the state space, say  $S$ , of  $\{Z_n, n = 1, 2, \dots\}$  (10%)
- (b) Assume that you have found the steady state distribution of  $\{Z_n, n = 1, 2, \dots\}$ :  $\pi_k, k \in S$ . Basing on  $\pi_k, k \in S$ , give the expression of the proportion of rainy day (You need not to find the value of  $\pi_k, k \in S$ ). (10%)



1. 何謂 available to promise (ATP)? (5%)
2. 平衡生產線圖(balance of line)之用途何在?並說明建構該圖所需之資訊。(5%)
3. 在預測模式中,請說明天真法(naïve method)和指數平滑法(exponential smoothing method)之差異何在。(5%)
4. 請說明重複性(repetitive)生產之特性,並舉兩例適合此類型生產模式之產品。(10%)
5. 對於處理專案管理問題之兩種手法:要徑法(critical path method)與計畫評核術(PERT)上,若完工時間為 48 天,則兩種手法在 48 天完工之機率分別為若干?另若欲縮減完工時間一日,則你的趕工策略將為何,方能使成本最小化。(10%)
6. 考量一包含 9 作業之生產線平衡問題,假設每日之需求量为 300 單位,可用之時間為 480 分鐘,則原先三個工作站之配置(工作站#1: B, 工作站#2: D、A、C、E, 工作站#3: F、G、H、I),恰能滿足需求。若欲將每日之需求提高為 320 單位,則身為現場主管的你,請以階位法(ranked positional weight, RPW)調整生產線,並說明你的方案。(15%)  
 (註:若有需要,請自行說明你的假設)





7. 某輪胎公司每每週的輪胎需求呈現平均值為250個，標準差為100個的常態分佈。該公司採購經理對此輪胎的訂購方式為只要輪胎庫存降低至600個就進行採購。假設每次訂購批量為1,000個，訂購後需要2週供應商才會將訂購的輪胎送達這家公司。請問這家公司對此輪胎設定的安全庫存量是多少？（10%）
8. 請參考下列資料評估某公司MRP之訂購批量（Lot Sizing）應該是採取EOQ方式還是採取Part Period方式來決定成本較低。假設訂購成本（Ordering Cost）為每一定單250元，庫存成本（Carrying Cost），每個每週2元，前置時間（Lead Time）為一週。（20%）

	週 期					
	1	2	3	4	5	6
淨需求(Net Requirement)	50	80	90	50	30	60

9. 下表顯示在某工作中心等待加工的6件工件的加工時間(Processing Time)及到期時間（Due Date）。此外，進行加工時部分工件必須依照下列順序完成：(1)1→2→3 (2) 工件5及工件6必須等工件4完成後才能進行加工。請決定能夠滿足上述兩種加工完成順序同時達到最小化最大延遲時間(Minimize the Maximum Lateness)的加工順序。（20%）

工件	1	2	3	4	5	6
加工時間	1	4	4	3	2	1
到期時間	3	6	9	7	11	7



1. (5 分) Identify the scale of measurement (nominal, ordinal, interval, or ratio) for the following variables.
  - (A) Time required completing a special task.
  - (B) Brand of cigarettes most often purchased.
2. (10 分) Before marketing new products nationally, companies often test them on samples of potential customers. Such tests have a known reliability. For a particular product type, a test will indicate success of the product 75% of the time if the product is indeed successful and 15% of the time when the product is not successful. From past experience with similar products, a company knows that a new product has 0.6 chance of success on national market. If the test indicates that the product will be successful, what is the probability that it really be successful?
3. (5 分) A shipment of 24 electric component is rejected is 3 checked for defects and at least 1 is found to be defective. Find the probability that the shipment will be returned if there are actually 6 components are defective.
4. (10 分) Let  $Y_1$  be the amount of pollutant per sample collected above the stack without the cleaning device and  $Y_2$  be the amount collected above the stack with the cleaner. The joint density of  $Y_1$  and  $Y_2$  is

$$f(y_1, y_2) = \begin{cases} 1, & 0 \leq y_1 \leq 2, 0 \leq y_2 \leq 1, 2y_2 \leq y_1 \\ 0, & \text{elsewhere.} \end{cases}$$

The random variable  $(Y_1 - Y_2)$  represents the amount by which the weight of pollutant can be reduce by using the cleaning device. Find  $E(Y_1 - Y_2)$ .

5. (10 分) The length of time a battery lasts in a radio is normally distributed with a mean of 15.6 hours and a standard deviation of 0.85 hours.
  - (A) For a randomly selected battery, what is the probability it lasts more than 17 hours?
  - (B) Find the length of time,  $x_0$ , for which 80% for batteries last less than  $x_0$ .
6. (10 分) A survey by the Society for Human Resource Management asked 346 job seekers why employees change jobs so frequently. The answer selected most 152 times was "higher compensation elsewhere".
  - (A) What is the point estimate of the proportion of job seekers who would select "higher compensation elsewhere" as the reason for changing jobs?
  - (B) What is the 98% confidence interval estimate of the population proportion?



7. (15 分) Consider the following data.

x	1	2	3	4	5	6	7
y	8	17	29	34	46	42	52

(A) Fit a regression curve of the form  $E(Y|x) = \beta_0 + \beta_1 x$ .

(B) Use the following information to estimate the model of the form  $E(Y|x) = \beta_0 + \beta_1 x + \beta_2 x^2$ .

$$(X'X)^{-1} = \begin{bmatrix} 2.428571 & -1.28571 & .1428571 \\ -1.28571 & .797619 & -.0952381 \\ .1428571 & -.0952381 & .01190476 \end{bmatrix} \quad X'y = \begin{bmatrix} 228 \\ 1111 \\ 6091 \end{bmatrix} \quad \text{and } s^2 = 12.274$$

(C) Test an appropriate hypothesis with  $\alpha = .05$  to decide whether the quadratic regression curve significantly fits the data better than the linear regression curve.

8. (10 分) Consider the random variable  $X$  with density given by

$$f(x) = (1 + \theta)x^\theta \quad 0 < x < 1 \quad \theta > -1$$

(A) Find the method of moments estimator for  $\theta$ .

(B) Find the maximum likelihood estimator for  $\theta$ .

9. (15 分) A quality engineer conducted an experiment to investigate the effect of experience on an assembly line in terms of average time required to complete an assembly task. If experience is found to be a factor, a training program is planned for newer employees. The engineer randomly selected five employees from groups who had completed 1, 2, 3, and 4 years of work experiences, respectively. He set up the experiment as a randomized block design with tasks as blocks and years of experiences as treatments. The assembly time data are given below.

Task	Experiences			
	1 year	2 years	3 years	4 years
1	40.3	34.2	28.8	26.6
2	25.4	25.4	29.2	21.1
3	28.2	28.0	24.6	23.2
4	41.6	24.9	29.1	27.0
5	28.8	39.2	34.8	27.1

(A) Write the appropriate statistical model for this experiment.

(B) Test for any significant differences among years of experiences for average assembly time. Use  $\alpha = 0.05$ .

(C) Was blocking necessary? Explain.

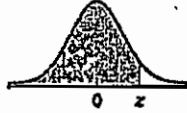
10. (10 分) While testing a used tape for bad records, a computer operator counted the number of flaws per 100 feet of tape. Let  $X$  equal this random variable. Test the null hypothesis that  $X$  has a Poisson distribution with a mean of  $\lambda = 2.4$  given that 40 observations of  $X$  yielded 5 zeros, 7 ones, 12 twos, 9 threes, 5 fours, 1 five, and 1 six. Use  $\alpha = 0.05$ .



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TABLE II (cont.)  
Areas under the  
standard normal curve



z	Second decimal place in 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
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000†									

† For  $z \geq 3.90$ , the areas are 1.0000 to four decimal places.

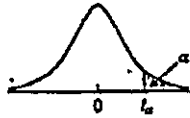




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TABLE IV  
Values of  $t_{\alpha}$



df	$t_{0.10}$	$t_{0.05}$	$t_{0.025}$	$t_{0.01}$	$t_{0.005}$	df
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
30	1.310	1.697	2.042	2.457	2.750	30
31	1.309	1.696	2.040	2.453	2.744	31
32	1.309	1.694	2.037	2.449	2.738	32
33	1.308	1.692	2.035	2.445	2.733	33
34	1.307	1.691	2.032	2.441	2.728	34
35	1.306	1.690	2.030	2.438	2.724	35
36	1.306	1.688	2.028	2.434	2.719	36
37	1.305	1.687	2.026	2.431	2.715	37
38	1.304	1.686	2.024	2.429	2.712	38
39	1.304	1.685	2.023	2.426	2.708	39
40	1.303	1.684	2.021	2.423	2.704	40
41	1.303	1.683	2.020	2.421	2.701	41
42	1.302	1.682	2.018	2.418	2.698	42
43	1.302	1.681	2.017	2.416	2.695	43
44	1.301	1.680	2.015	2.414	2.692	44
45	1.301	1.679	2.014	2.412	2.690	45
46	1.300	1.679	2.013	2.410	2.687	46
47	1.300	1.678	2.012	2.408	2.685	47
48	1.299	1.677	2.011	2.407	2.682	48
49	1.299	1.677	2.010	2.405	2.680	49



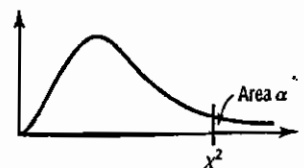
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Table G The Chi-Square Distribution

Degrees of freedom	$\alpha$									
	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.262	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

Source: Owen, Handbook of Statistical Tables, Table A-4 "Chi-Square Distribution Table," © 1962 by Addison-Wesley Publishing Company, Inc. Copyright renewal © 1990. Reproduced by permission of Pearson Education, Inc.





國立雲林科技大學 103 學年度  
碩士班招生考試試題

系所：工管系、資管系  
科目：統計學(1)

Table H (Continued)

*F* distribution

$\alpha = 0.05$

d.f.N.: degrees of freedom, numerator

degrees of freedom, denominator	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	$\infty$
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.20	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.07	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.05	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.17	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.88	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	2.00	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
$\infty$	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00



國立雲林科技大學 103 學年度  
碩士班招生考試試題

系所：工管系  
科目：微積分(2)

(證明題, 每題 6.25 分) - 證明題須列出計算過程

1. Prove  $\frac{d}{dx}(\ln x) = 1/x$  [提示:  $y = \ln x$ ,  $e^y = e^{\ln x} = x, \dots$ ]

(填充題, 每題 6.25 分)

2. Evaluate  $\lim_{h \rightarrow 0} \frac{(h+3)^2 - 9}{h}$

3. Find equations of the tangent lines to the curve  $y = \frac{x-1}{x+1}$  that are parallel to the line  $x-2y=2$

4. Find the derivative of the function  $f(x) = \left(\frac{x-2}{2x+1}\right)^9$ . Express the fraction in the simplest form.

5. Find the inverse  $f^{-1}(x)$  of the function  $f(x) = (4x-1)/(2x+3)$

6. Solve the equation for  $x$  where  $e^{2x+3} - 7 = 0$

7. Differentiate  $f(x) = x \ln(1+e^x)$

8. Find the limit  $\lim_{x \rightarrow 0} (e^x - \frac{1}{2}x^2 - x - 1)/x^3$

9. Determine whether the series  $\sum_{n=1}^{\infty} \frac{(-1)^n \sqrt{n}}{\ln n}$  is convergent or divergent.

10. Find the radius of convergence and interval of convergence of the series  $\sum_{n=1}^{\infty} \frac{2^n (x-2)^n}{(n+2)!}$

11. Find  $\int_0^{\pi/2} \cos^3 x \sin 2x dx$

12.  $t \ln t \frac{dr}{dt} + r = te^t$ , find  $r(t)$ .

13. Find the maximum rate of change of  $f(x, y) = x^2 y + \sqrt{y}$  at the given point (2,1) and the direction in which it occur.

14. Evaluate  $\iint_D xy dA$ , where  $D$  is the region bounded by the line  $y = x-1$  and  $y^2 = 2x+6$ .

15. Find the linear approximation of the function  $f(x, y, z) = \sqrt{x^2 + y^2 + z^2}$  at the given point (3,2,6).

16. Find  $\int_0^2 x^2 \ln x dx$



1. (5 分) Please define the following terminologies(專有名詞解釋)。
  - (A) Population parameter
  - (B) Inferential Statistics
  
2. (10 分) John, Mary, and Jane fill orders in a restaurant. John **incorrectly** fills 15% of the orders he takes. Mary **correctly** fills 75% of the orders she takes, and Jane **incorrectly** fills 10% of the order she takes. John fills 30% of all orders, and Mary fills 40% of all orders. 600 orders are filled. Answer the following questions.
  - (A) If the orders were filled by Jane, what is the probability that it was filled incorrectly?
  - (B) If the order was filled incorrectly, what is the probability that John fill it?
  
3. (8 分) The amount of fuel consumed by the engines of a jetliner on a flight between two cities is a normally distributed random variable  $X$  with a mean  $\mu=5.7$  tons and standard deviation  $\sigma=0.5$ . Carrying too much fuel is inefficient as it slows the plane. If, however, too little fuel is loaded on the plane, an emergency landing may be necessary. Find the amount of fuel to load so that there will be a 0.99 probability that the plane will arrive at its destination.
  
4. (5分) 在MA121教室的15台電腦中，有5台電腦是故障的，有10台電腦是可供使用，試問任意選擇5台電腦，剛好有三台是故障電腦的機率為何？
  
5. (10 分) The proportion of time per day that all checkout counters in a supermarket are busy is a random variable  $Y$  with a density function given by
 
$$f(y) = \begin{cases} cy^2(1-y)^4, & 0 \leq y \leq 1 \\ 0, & \text{elsewhere} \end{cases}$$
  - (A) Find the value of  $c$  that makes  $f(y)$  a probability function.
  - (B) Find  $E(Y)$ .
  
6. (12 分) A new medicine has a 70% success rate. Thirty patients are treated with it. Let  $X$  denotes the number of patients treated successfully.
  - (A) What is the probability that exactly eighteen are cured with this new medicine?
  - (B) Compute  $P(X \leq 15)$  by using Normal approximation.

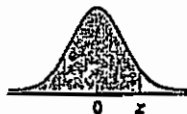


國立雲林科技大學 103 學年度  
碩士班招生考試試題

系所：工管系

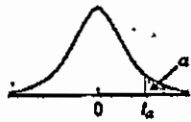
科目：統計學(2)

TABLE II (cont.)  
Areas under the  
standard normal curve



z	Second decimal place in 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
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.7	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.8	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999	0.9999
3.9	1.0000†									

† For  $z \geq 3.90$ , the areas are 1.0000 to four decimal places.


 TABLE IV  
 Values of  $t_{\alpha}$ 


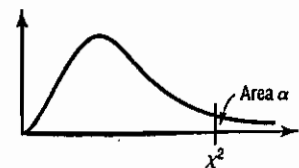
df	$t_{0.10}$	$t_{0.05}$	$t_{0.025}$	$t_{0.01}$	$t_{0.005}$	df
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	7
8	1.397	1.860	2.306	2.896	3.355	8
9	1.383	1.833	2.262	2.821	3.250	9
10	1.372	1.812	2.228	2.764	3.169	10
11	1.363	1.796	2.201	2.718	3.106	11
12	1.356	1.782	2.179	2.681	3.055	12
13	1.350	1.771	2.160	2.650	3.012	13
14	1.345	1.761	2.145	2.624	2.977	14
15	1.341	1.753	2.131	2.602	2.947	15
16	1.337	1.746	2.120	2.583	2.921	16
17	1.333	1.740	2.110	2.567	2.898	17
18	1.330	1.734	2.101	2.552	2.878	18
19	1.328	1.729	2.093	2.539	2.861	19
20	1.325	1.725	2.086	2.528	2.845	20
21	1.323	1.721	2.080	2.518	2.831	21
22	1.321	1.717	2.074	2.508	2.819	22
23	1.319	1.714	2.069	2.500	2.807	23
24	1.318	1.711	2.064	2.492	2.797	24
25	1.316	1.708	2.060	2.485	2.787	25
26	1.315	1.706	2.056	2.479	2.779	26
27	1.314	1.703	2.052	2.473	2.771	27
28	1.313	1.701	2.048	2.467	2.763	28
29	1.311	1.699	2.045	2.462	2.756	29
30	1.310	1.697	2.042	2.457	2.750	30
31	1.309	1.696	2.040	2.453	2.744	31
32	1.309	1.694	2.037	2.449	2.738	32
33	1.308	1.692	2.035	2.445	2.733	33
34	1.307	1.691	2.032	2.441	2.728	34
35	1.306	1.690	2.030	2.438	2.724	35
36	1.306	1.688	2.028	2.434	2.719	36
37	1.305	1.687	2.026	2.431	2.715	37
38	1.304	1.686	2.024	2.429	2.712	38
39	1.304	1.685	2.023	2.426	2.708	39
40	1.303	1.684	2.021	2.423	2.704	40
41	1.303	1.683	2.020	2.421	2.701	41
42	1.302	1.682	2.018	2.418	2.698	42
43	1.302	1.681	2.017	2.416	2.695	43
44	1.301	1.680	2.015	2.414	2.692	44
45	1.301	1.679	2.014	2.412	2.690	45
46	1.300	1.679	2.013	2.410	2.687	46
47	1.300	1.678	2.012	2.408	2.685	47
48	1.299	1.677	2.011	2.407	2.682	48
49	1.299	1.677	2.010	2.405	2.680	49



Table G The Chi-Square Distribution

Degrees of freedom	$\alpha$									
	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860
5	0.412	0.554	0.831	1.145	1.610	9.236	11.071	12.833	15.086	16.750
6	0.676	0.872	1.237	1.635	2.204	10.645	12.592	14.449	16.812	18.548
7	0.989	1.239	1.690	2.167	2.833	12.017	14.067	16.013	18.475	20.278
8	1.344	1.646	2.180	2.733	3.490	13.362	15.507	17.535	20.090	21.955
9	1.735	2.088	2.700	3.325	4.168	14.684	16.919	19.023	21.666	23.589
10	2.156	2.558	3.247	3.940	4.865	15.987	18.307	20.483	23.209	25.188
11	2.603	3.053	3.816	4.575	5.578	17.275	19.675	21.920	24.725	26.757
12	3.074	3.571	4.404	5.226	6.304	18.549	21.026	23.337	26.217	28.299
13	3.565	4.107	5.009	5.892	7.042	19.812	22.362	24.736	27.688	29.819
14	4.075	4.660	5.629	6.571	7.790	21.064	23.685	26.119	29.141	31.319
15	4.601	5.229	6.262	7.261	8.547	22.307	24.996	27.488	30.578	32.801
16	5.142	5.812	6.908	7.962	9.312	23.542	26.296	28.845	32.000	34.267
17	5.697	6.408	7.564	8.672	10.085	24.769	27.587	30.191	33.409	35.718
18	6.265	7.015	8.231	9.390	10.865	25.989	28.869	31.526	34.805	37.156
19	6.844	7.633	8.907	10.117	11.651	27.204	30.144	32.852	36.191	38.582
20	7.434	8.260	9.591	10.851	12.443	28.412	31.410	34.170	37.566	39.997
21	8.034	8.897	10.283	11.591	13.240	29.615	32.671	35.479	38.932	41.401
22	8.643	9.542	10.982	12.338	14.042	30.813	33.924	36.781	40.289	42.796
23	9.262	10.196	11.689	13.091	14.848	32.007	35.172	38.076	41.638	44.181
24	9.886	10.856	12.401	13.848	15.659	33.196	36.415	39.364	42.980	45.559
25	10.520	11.524	13.120	14.611	16.473	34.382	37.652	40.646	44.314	46.928
26	11.160	12.198	13.844	15.379	17.292	35.563	38.885	41.923	45.642	48.290
27	11.808	12.879	14.573	16.151	18.114	36.741	40.113	43.194	46.963	49.645
28	12.461	13.565	15.308	16.928	18.939	37.916	41.337	44.461	48.278	50.993
29	13.121	14.257	16.047	17.708	19.768	39.087	42.557	45.722	49.588	52.336
30	13.787	14.954	16.791	18.493	20.599	40.256	43.773	46.979	50.892	53.672
40	20.707	22.164	24.433	26.509	29.051	51.805	55.758	59.342	63.691	66.766
50	27.991	29.707	32.357	34.764	37.689	63.167	67.505	71.420	76.154	79.490
60	35.534	37.485	40.482	43.188	46.459	74.397	79.082	83.298	88.379	91.952
70	43.275	45.442	48.758	51.739	55.329	85.527	90.531	95.023	100.425	104.215
80	51.172	53.540	57.153	60.391	64.278	96.578	101.879	106.629	112.329	116.321
90	59.196	61.754	65.647	69.126	73.291	107.565	113.145	118.136	124.116	128.299
100	67.328	70.065	74.222	77.929	82.358	118.498	124.342	129.561	135.807	140.169

Source: Owen, *Handbook of Statistical Tables*, Table A-4 "Chi-Square Distribution Table," © 1962 by Addison-Wesley Publishing Company, Inc. Copyright renewal © 1990. Reproduced by permission of Pearson Education, Inc.







國立雲林科技大學 103 學年度  
碩士班招生考試試題

系所：工管系  
科目：統計學(2)

Table H

*F* distribution

$\alpha = 0.05$

d.f.D.: degrees of freedom, numerator.

d.f.D.	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30	40	60	120	$\infty$
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.63	2.54	2.51	2.47	2.43	2.38	2.34	2.30
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.80	1.74	1.69	1.64	1.58	1.51
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.70	1.65	1.59	1.53	1.47	1.39
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25
$\infty$	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00



本試題共 11 題，共計 100 分。

1. (12 points) Jane receives utility from days spent traveling on vacation domestically (D) and days spent traveling on vacation in a foreign country (F), as given by the utility function  $U(D,F)=10DF$ . In addition, the price of a day spent traveling domestically is \$100, the price of a day spent traveling in a foreign country is \$400, and Jane's annual travel budget is \$4000.
  - a. Illustrate the indifference curve associated with a utility of 800 and the indifference curve associated with a utility of 1200.
  - b. Graph Jane's budget line on the same graph.
  - c. Can Jane afford any of the bundles that give her a utility of 800? What about a utility of 1200?
  - d. Find Jane's utility-maximizing choice of days spent traveling domestically and days spent in a foreign country.
  
2. (8 points) Do the following functions exhibit increasing, constant, or decreasing returns to scale?
  - a.  $Q=3L+2K$
  - b.  $Q=(2L+2L)^{1/2}$
  - c.  $Q=3LK^2$
  - d.  $Q=L^{1/2}K^{1/2}$
  - e.  $Q=4L^{1/2}+4K$
  
3. (10 points) Suppose that a firm's production function is  $q=10L^{1/2}K^{1/2}$ . The cost of a unit of labor is \$20 and the cost of a unit of capital is \$80.
  - a. The firm is currently producing 100 units of output and has determined that the cost-minimizing quantities of labor and capital are 20 and 5, respectively. Graphically illustrate this using isoquants and isocost lines.
  - b. The firm now wants to increase output to 140 units. If capital is fixed in the short run, how much labor will the firm require? Illustrate this graphically and find the firm's new total cost.
  - c. If the marginal rate of technical substitution is  $K/L$ , find the optimal level of capital and labor required to produce the 140 units of output.
  
4. (10 points) A sales tax of \$1 per unit of output is placed on a particular firm whose product sells for \$5 in a competitive industry with many firms.
  - a. How will this tax affect the cost curves for the firm?
  - b. What will happen to the firm's price, output, and profit?



- c. Will there be entry or exit in the industry?
5. (10 points) A monopolist faces the following demand curve:  
$$Q=144/P^2$$
where Q is the quantity demanded and P is price. Its average variable is  
$$AVC=Q^{1/2}$$
and its fixed cost is 5.
- What are its profit-maximizing price and quantity?
  - Suppose the government regulates the price to be no greater than \$4 per unit. How much will the monopolist produce? What will its profit be?
  - Suppose the government wants to set a ceiling price that induces the monopolist to produce the largest possible output. What price will accomplish this goal?
6. (10 points) For this question, assume that the economy is initially operating at the natural level of output. What effects will a simultaneous increase in taxes and increase in the money supply have on output and investment in the medium run?
7. (12 points) In the short run, what effects will a reduction in the price of oil have on output and the interest rate? In the medium run, what effects will the reduction in the price of oil have on unemployment rate?
8. (10 points) Assume an economy with a production function represented by  $Y = F(K, NA)$ , where Y denotes outputs, K denotes capital stocks, N denotes labors, and A denotes the effectiveness of labors. The rate of capital depreciation is 10% per year, the population growth rate is 2% per year, and the growth rate of technology is 3% per year.  
Refer to the information above.
- What is the annual growth rate of "effective labor" in the steady state in this economy?
  - What is the level of investment needed to maintain constant capital per effective worker ( $K/NA$ ) in this economy?
  - What is the steady-state growth rate of output in this economy?
  - What is the steady-state growth rate of output per worker in this economy?
9. (10 points) Suppose an economy experiences a reduction in productivity. What are both the short-run and medium-run effects of this reduction in productivity on



output and the unemployment rate?

10. (4 points) Suppose firms expect future output to be higher and future interest rates to be higher. Given this information, how will firms alter investment in the current period?

11. (4 points) How could an increase in expected future output affect current output?