



1. (18%) Please answer the following questions (True or False). For each question, you get +3 points if your answer is correct; you get -3 points if your answer is incorrect; and you get nothing if you don't answer the question. Questions (a) - (d) refer to the following "primal/dual pair" LPs, where A is $m \times n$:

$$(P) \quad \begin{cases} \min & Z(x) = \mathbf{0}^T x \\ \text{s.t.} & Ax = b \\ & x \geq \mathbf{0}, \end{cases} \quad (D) \quad \begin{cases} \max & W(x) = b^T y \\ \text{s.t.} & A^T y \leq \mathbf{0} \end{cases}$$

- (a) If \hat{x} is feasible in problem (P) and \hat{y} is feasible in problem (D), then $b^T \hat{y} \leq 0$.
- (b) If problem (P) is infeasible, then problem (D) is either unbounded or infeasible.
- (c) If we change "equalities" in the constraint of problem (P) into "inequalities" (replacing $Ax = b$ with $Ax \geq b$), then its dual is unchanged except adding the nonnegative restriction in (D), i.e., adding $y \geq \mathbf{0}$.
- (d) If $\bar{y} = (\bar{y}_1, \bar{y}_2, \dots, \bar{y}_m) = (0, 0, \dots, 0)$, then \bar{y} is a basic feasible solution in problem (D).
- (e) If a transportation problem is balanced, it must have optimal integer solutions.
- (f) The critical path in a project network is the longest path from a specified source node (beginning of project) to a specified destination node (end of project).

2. (10%) Below is a simplex tableau for one maximization LP problem.

Z	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	RHS
1	3	0	1	3	0	0	2	0	36
0	3	0	4	1	0	1	3	0	9
0	-1	1	2	5	0	0	-2	1	2
0	6	0	3	-2	1	0	-4	-3	0

Please answer the following questions:

- (a) What are the current basic variables? What is the current solution?
 - (b) Is the current solution degenerate? Why?
 - (c) Is the current solution optimal? Why?
 - (d) Which basic variable can be replaced by which nonbasic variable without reducing the objective function value?
 - (e) Does this problem have multiple optimal solutions? Why?
3. (12%) Consider the following linear programming problem:

$$(LP1) \quad \begin{cases} \max & 3x_1 + 6x_2 + 9x_3 \\ \text{s.t.} & 4x_1 + 7x_2 + 10x_3 \leq 20 \\ & x_j \geq 0, \text{ for } j = 1, 2, 3 \end{cases}$$

- (a) Write down the dual problem of (LP1) and solve it using the graphic method. (5%)
- (b) Use the dual optimal solution you have in (a) and the complementary slackness conditions to find the primal optimal solution of (LP1). (7%)



4. (10%) This is a special girls-boys matching problem. There are three girls (Daisy, Emily and Fanny) and three boys (Adam, Bard and Carl) to be matched (each girl is assigned to one boy exactly, and each boy is also assigned to one girl exactly). We are going to match them according to the points assigned by the girls. Each girl independently distributes 30 points across these three boys, depending on her preference. Our goal is to find matchings which have maximum total points. The points that are given by the girls are summarized in the following table.

	Adam	Bard	Carl
Daisy	15	5	10
Emily	6	12	12
Fanny	10	15	5

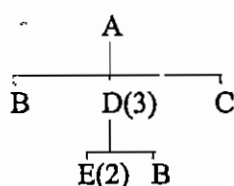
- (a) Given an Integer Programming for this problem. (5%)
- (b) Notice that this is a special Assignment Problem. Use Hungarian Method to solve this problem. (Hint: The original version of Hungarian method are designed to find the minimum cost.) (5%)
5. Consider a M/M/1/3 queue. The arrival is a Poisson process with rate λ and service is exponential of rate μ_1 if there are less than two items in the system, of rate μ_2 if there are more than 1 item in the system. Assume $\mu_1 < \mu_2$. The system incurs a holding cost, h , charged per unit time for each item while it is in the system. Furthermore, when the service is granted at rate μ_i there is an operating cost at rate c_i ($i = 1, 2$) per unit operating time charged to the system.
- (a) Define the state as number of items in the system. Draw the transition rate diagram of the system (5%)
- (b) What conditions on λ, μ_1 and μ_2 are needed to ensure this system to be stable. (5%)
- (c) Find the steady state distribution of the system. (5%)
- (d) Find the probability of an arrival being rejected. (5%)
- (e) What is average time in system per item? (7%)
- (f) If each accepted arrival brings in a reward of R to the system at its service completion epoch, find the average profit per unit time of the system. (8%)
- (g) Assume that there is a probability of α that the output of the M/M/1/3 is defective. If the system is not full at service completion the defective item is fed back to the end of the queue for reprocessing, if the system is full, the defective item is discarded. Draw the transition rate diagram of this revised system and write down the corresponding balance equations. (8%)
- (h) Consider the revised system but with only one waiting room (That is the system is M/M/1/2). Assume that the system earns a reward of R only if the output is good. Now let $\lambda = 1, \mu_1 = 1, \mu_2 = 2, R = 10$ and $\alpha = 0.5$ Find the average reward per unit time. (7%)



1. Sales in the swimsuit business vary on a seasonal basis. Sales (in thousands) for the past three years, on a quarterly basis, are as follows for a Company:

<u>Year 1</u>	<u>Sales</u>	<u>Year 2</u>	<u>Sales</u>	<u>Year 3</u>	<u>Sales</u>
Q1	12	Q1	13	Q1	14
Q2	16	Q2	18	Q2	20
Q3	18	Q3	17	Q3	18
Q4	9	Q4	10	Q4	11

- (1) Using the data in first two years to develop a forecast model to predict the sales for year 3.(15%)
- (2) Compare the forecast results obtained in part(1) with those obtained from three-period moving average forecast. Which method has better forecast? Explain it. (10%)
2. Assumed the computer of a company breakdown just after it generated the following information : Planned order release for item E = 200 units in week four. The company can reconstruct all the information they lost except the master schedule for end product A. The company is fortunate because item E is used only in A. Given the following product structure tree and associated inventory status record information, determine what master schedule entry for A was exploded into the material requirement plan that killed the computer. (25%)



Part #	On hand Inventory	Lot Sizing	Lead time
A	20	Lot-for lot	1 week
B	40	Lot-for lot	2 week
C	10	Lot-for-lot	1 week
D	30	Lot-for-lot	2 week
E	20	Lot-for-lot	1 week



3. A machine shop process customer orders from a variety of clients. One of the machines, a driller, has six jobs remaining to be processed. The processing time and due date for the six jobs are given below. Try to determine the sequence of job in order to minimize:

- (1) Maximum lateness (10%)
(2) Number of tardy job (15%)

Job	1	2	3	4	5	6	7
Due Date	4	8	12	15	11	25	21
Processing Time	3	6	8	4	2	1	7

4. A manufacturing company wants to accelerate a project it has underway for a new product in order to beat their competitors to market. They used CPM to develop the project which has the following activities, durations (in weeks), costs (in dollars), and precedence relationships. What is the final project duration in weeks?
(assuming it is crashed as far as possible) (25%)

Activity	Immediate	Present		Accelerated	
	Predecessors	Duration	Cost	Duration	Cost
a	--	3	3300	2	3400
b	--	5	4100	3	4500
c	a	4	3700	3	3800
d	b	5	5900	4	6000
e	c	6	6700	4	6900
f	c	4	4100	3	4150
g	d, e	6	9100	3	9700
h	f, g	5	2700	4	3000



一、有一圖書租借中心擬發展一套圖書租借歸還系統，系統需求如下：

- 1) 櫃台客服部門，接受顧客租借圖書需求後，櫃台客服部門為顧客辦理圖書租借處理，圖書租借處理模組功能包括：依據顧客書籍租借資料，計算租借金額，產生租借清單資料給客戶，並更新圖書庫存數量資料，輸出租借清單如附表(一)。
- 2) 當客服部門，接受顧客租借圖書歸還需求後，辦理圖書歸還處理，歸還處理模組功能包括：依據顧客歸還書籍資料，計算逾期天數，罰款金額，產生圖書歸還清單給客戶，並更新圖書庫存數量資料，輸出歸還清單如附表(二)。

附表(一) 租借清單

租借清單編號:					
客戶:			客戶編號:		
地址:					
電話:			租借日期:		
圖書編號:	圖書名稱:	單價:	租借期限:	租借數量:	金額:
客戶簽章:		承辦人:		租借總金額:	

附表(二) 歸還清單

歸還清單編號:						
客戶:				客戶編號:		
地址:						
電話:				歸還日期:		
圖書編號:	圖書名稱:	歸還數量:	租借期限:	逾期天數:	每日逾期罰款:	罰款金額:
客戶簽章:		承辦人:		罰款總金額:		

1. 系統分析 (25%) :

請簡述如何利用結構化或物件導向系統分析方法來分析「圖書租借歸還系統」。並且使用相關的工具圖形來描述系統，如資料流程圖(Data Flow Diagram)或類別圖(Class Diagram) ...等圖。(結構化或物件導向擇一答題即可)



2. 資訊架構 (25%) :

一般為多重使用者開發的資訊系統有「主-從架構」與「3 層式架構」設計，請針對「圖書租借歸還系統」的設計簡述兩種架構的概念並比較優缺點。

3. 物件(Object)設計 (25%) :

假設此系統會使用到一「實數排序物件」，請簡述該物件儲存實數資料(attribute)的結構設計，與該物件排序方法(method)之虛擬碼(pseudo code)。(請使用任何合適有效的設計)

4. 資料庫關聯表規畫 (25%) :

請簡述「圖書租借歸還系統」關聯式資料庫之規畫流程。並由附表(一)及附表(二)歸納出相關實體及屬性，並繪出實體關係圖及產生正規化後之關聯表。



1. [10 points] Plot the function $f(x) = 2 + 3xe^{-x}$ and also calculate its
 - (a) critical points;
 - (b) relative maximum (minimum) points; and
 - (c) inflection points.
2. [10 points] Find $\lim_{x \rightarrow 0} (2x + e^x)^{\frac{1}{x}}$.
3. [10 points] Calculate $\int \frac{(2x+1)}{x(x+1)^2} dx$.
4. [10 points] Find $\lim_{n \rightarrow \infty} \frac{(n+1)^k + (n+2)^k + \dots + (n+n)^k}{n^{k+1}}$
5. [10 points] Let $T = \{(x, y) | 0 \leq y \leq x; 0 \leq x \leq \frac{\pi}{2}\}$ and $f(x, y) = 2x^2y + \sin x$. Please find the integral of $f(x, y)$ over the triangle T .
6. [20 points] Let A be an $n \times n$ matrix. For each of the following statements, check whether it is true or false. Justify your answer.
 - (a) It is possible to have only two different solutions for a linear system $Ax = 0$.
 - (b) If A is an invertible symmetric matrix, then A^{-1} is also a symmetric matrix.
 - (c) If A is orthogonal, then $\det(A) = 1$ or $\det(A) = -1$.
 - (d) If $AB = AC$ then $B = C$, where B and C are $n \times n$ matrices.
7. [15 points] Let $A = \begin{bmatrix} 1 & 5 & 3 \\ -2 & 6 & 2 \\ 3 & -1 & 1 \end{bmatrix}$.
 - (a) Use Gaussian Elimination to find the solution of $Ax = 0$.
 - (b) Is $\{x \in R^3 | Ax = 0\}$ a subspace of R^3 . Why? Explain your answer.
 - (c) Determine whether the column vectors of A form a linear dependent set or a linearly independent set.
8. [15 points] Let $A = \begin{bmatrix} 4 & -5 \\ -3 & 2 \end{bmatrix}$.
 - (a) Find the eigenvalues and the associated eigenvectors of A .
 - (b) Is A diagonalizable? If yes, provide the matrix P diagonalizes A . Otherwise, explain why not.
 - (c) Find A^n (in simplest form), where n is positive integer.



I. Multiple Choice Questions (25%)

- Suppose the following set of data represents the number of hours ten different basketball players spent on practicing during the weekend: 5, 8, 7, 9, 62, 5, 7, 11, 12, 10. Which of the following measures would provide the best indication of the typical number of hours these basketball players spent practicing?
 - the variance
 - the standard deviation
 - the mean
 - the median
 - the range divided by 10
- If X is a binomial random variable with $n=400$ and $p=0.5$ then which of the following is true.
 - $E(X)=200$.
 - The standard deviation of X is 10.
 - The distribution X is well approximate by a normal distribution.
 - All of the above are true.
 - Only (a) and (b) are true.
 - Only (b) and (c) are true.
 - Only (a) and (c) are true.
- A company tests the water supply everyday by taking random sample of water throughout the day. On each day they construct a 90% confidence interval for the mean amount chlorine in the water. Over the course of a year they calculate 365 different confidence intervals, one interval for each day. Which of the following is appropriate to this situation?
 - From year to year, the company should expect that about 36 of the 365 intervals will not contain the mean chlorine level for the day which the interval was constructed.
 - For each day, the interval obtained, on that day, gives a range that includes 90% of all possible chlorine for that day.
 - In a single year, there is a high probability that at least one of 365 intervals will not contain the mean for the day on which the interval was constructed.
 - All of above are appropriate.
 - Only (a) and (b) are true.
 - Only (b) and (c) are true.
 - Only (a) and (c) are true.



4. The length of wait at a stoplight follows an exponential distribution with a mean 30 seconds and a standard of 30 seconds. Suppose $n=36$ cars were randomly sampled from this stoplight. Find the probability that the sample mean wait of 36 cars exceeded 35 seconds.

- (a) 0.4244
- (b) 0.3114
- (c) 0.4325
- (d) 0.1587

5. A small life insurance company has determined that it received an average of five death claims per day. If the number of death claims received per day can be explained by the Poisson probability distribution, what is the probability that the number of death claims received on randomly selected day will be exactly 4?

- (a) 0.440
- (b) 0.265
- (c) 0.175
- (d) 0.560



II
6.
(a)
(b)
7.





II. Problems (75%)

6. (15%) Suppose that X_1, X_2, X_3 , and X_4 are iid random variables from $N(\mu, 9)$ population, where $-\infty < \mu < \infty$ is the unknown parameter. We wish to test $H_0: \mu = 1$ versus

$H_a: \mu = 3$. Consider the test: Reject H_0 if and only if $\bar{x} > 1.5$

- (a) Find Type I and Type II error probabilities for the test.
(b) Evaluate the power at $\mu = 3$.

7. (10%) Suppose that Y_1, Y_2 , and Y_3 are random variables with common mean μ and common variance σ^2 . The random variables Y_1 and Y_3 are uncorrelated, $\text{Cov}(Y_1, Y_2) = k\sigma^2$, and $\text{Cov}(Y_1, Y_2) = -k\sigma^2$, where k is a positive constant. Define the statistics

$$T_1 = Y_1 - Y_3$$

$$T_2 = 2Y_1 + Y_2$$

Compute the correlation between T_1 and T_2 .

8. (20%) When current I flows through resistance R , the power generated is given by $W = I^2 R$. Suppose I has a uniform distribution over the interval $(0, 1)$ and R has a density function given by

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

Find the probability density function for W . (Assume I is independent of R .)

9. (20%) Below are the points scored by Michael Jordan of Chicago Bulls in the consecutive games for the regular season:

30 16 29 29 27 15 19 28 28 27

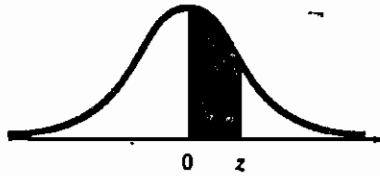
30 49 33 26 26 29 29 13 29 25

Perform randomness and normality checks on the data.

10. (10%) To fit the quadratic curve $y = \beta_1 + \beta_2 x + \beta_3 x^2$ to a set of points $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$ by the method of least squares, derive the normal equations required in estimating the regression parameters β_1, β_2 , and β_3 .



Normal Curve Areas



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990

Source: Abridged from Table I of A. Hald, *Statistical Tables and Formulas* (New York: Wiley), 1952. Reproduced by permission of A. Hald.



試題共一大題，總分計一百分。

下列是餐廳、醫院、及工廠的目的

餐廳：飢餓的客人進來，吃飽的客人離開。

醫院：生病的客人進來，痊癒的客人離開。

工廠：原料進來，成品離開。

為達成其目的，下列是餐廳、醫院、及工廠所須具備之處理單元

餐廳：侍者，廚房（大廚，二廚等），櫃檯。

醫院：醫師，病房，開刀房，藥局。

工廠：生管課，倉庫，加工一課，加工二課。

試從生產管理系統的角度（相關表單及流程），說明其異同，並發覺其共同可能存在之問題與解決方法。

註：先說明一個共通之表單及流程，再依餐廳、醫院、及工廠之不同性質說明表單之差異。或先說明餐廳、醫院、及工廠不同之表單及流程，再彙整一個共通之表單及流程。



問題一 (50%)：

- (a) 組織內所有製造產品及服務過程中，所牽涉的營運與活動之集合統稱為生產系統 (Production system)。一個生產系統由三個部分組成：投入(input)、產出(output)與流程(process)。請詳細說明貴公司的生產系統。(15%)
- (b) 在貴公司的各項流程中請舉出核心流程與支援性流程各一例，並請提出此核心流程與支援性流程中顧客(內部或外部顧客)在意的品質特性。(15%)
- (c) 請說明(b)小題中之核心流程可否再改善? Reengineering 是否用的上? (20%)

問題二 (50%)：

在任何企業的經營管理之中，經常有出乎意外的狀況發生，其中最常發生的就是各項專案已經啓動執行，但是經費突然被刪減而造成短缺。請以所附之「挑戰 2008：國家發展發展重點計畫」為假設案例，共有十個專案自 91 年起同時進行，但是立法院卻自 93 年起刪減 50% 的經費預算。請問如果你是國家的「專業經理人(行政院長?)」，你該如何在有限資源(時間、資金、人力等)下，以最小的衝擊(針對績效、原計畫目標、時程等)為目的，做出最適的調整？

- (a) 請詳列你個人在答題時，所認為必要的相關假設。(10%)
- (b) 請詳細說明你所提出的修正案的理由(或論點)。(20%)
- (c) 請詳細說明為何你所提出的方案是確切可行，並可達到你所訂定的目標。(20%)



附件：管理實務案例

「挑戰 2008：國家發展重點計畫」摘要
(行政院新聞局 <http://2008.gio.gov.tw/about2008.asp>)

國家重點發展計畫的規劃，主要係秉持綠色矽島規劃的基本理念，體現以人為本、永續發展的核心價值，發揮國家有限資源最大的效益，維繫世世代代國民的生存與福祉。

- 一、以人為本：國家發展重點計畫各項子計畫與方案的研擬，基本上均秉持人本的規劃理念，重視人力素質的提昇、人文素養的深化、優質生活環境的建設、在地文化的認同、為一個以人為本及以國民福祉提升為終極目標的投資計畫。
- 二、永續發展：國家發展重點計畫內容涵蓋經濟、人文與生活三大面向，旨在縮小過去經濟發展與生活、環境建設背離的落差、強調經濟成長、人文素質、生活環境的協調並進與相輔相成，以落實科技人文化、文化生活化、確保國家的永續發展。
- 三、十大重點投資計畫：

(1) E 世代人才培育

策略：營造國際化生活環境、提昇全民英語能力；推動全民網路教育；活力青少年教育；建立 E 世代終身學習的社會環境。

計畫目標：培育具有創意活力及國際對話能力的新世代，也就是能夠嫻熟應用「資訊與英語」的新世代。

(2) 文化創意產業發展

策略：成立文化創意產業推動組織；培育藝術、設計與創意人才；整備創意產業發展環境；發展創意設計產業及創意媒體產業。

計畫目標：開拓創意領土，結合人文與經濟發展文化產業。

(3) 國際創新研發基地

策略：吸引國際研發人才，引進全球研發資源；提供 500 億研發貸款，活絡創新研發活動；設立重點產業學院，鼓勵產、學、研合作培育產業人才，蓄積創新研發能量；成立創新研發中心，建構特殊領域研發優勢；推動重點產業科技研究，建立核心產業技術領域。

計畫目標：鼓勵民間投資研發，在六年內使研發投資達 GDP3%，建設台灣在特殊領域成為亞洲最好的創新研發基地。

(4) 產業高值化

策略：共同籌募 1,000 億元創投基金，擴大新興產業資金之取得管道；協助開發產業核心技術，包括電子/資訊、光電、通訊、機械、紡織、生技等，以提生產業附加價值、兩兆雙星產業、四大新服務業及綠色產業；獎勵投資國際通路與品牌；促進勞動力升級；開發建設產業園區，作為產業發展基地。

計畫目標：提高產業附加價值，建設台灣成為全球高附加價值產業的生產及供應中心。

**(5) 觀光客倍增**

策略：整備現有套裝旅遊路線；開發新興套裝旅遊路線及新景點；建置觀光旅遊服務網；宣傳推廣國際觀光；發展會議展覽產業。

計畫目標：發展台灣成為優質觀光目的地，並使來台旅客六年內成長到 500 萬人次。

(6) 數位台灣

策略：發展寬頻到家所需的基礎設施；積極扶持新興且具高潛力的數位產業，包括數位娛樂、數位典藏、數位學習等；推動電子化應用，包括電子化政府、智慧型交通系統、產業/企業電子化、網路化社會等。

計畫目標：六年 600 萬戶寬頻到家，建設台灣成為亞洲最 e 化的國家。

(7) 營運總部

策略：規劃自由港區；以全套的租稅行政措施，協助企業籌設運籌總部；建設北、中、南三大海空聯港，整合海空運，以配合複合性運輸之需求；簡化各項通關貿易文件與作業，使通關無障礙；產業全球運籌電子化，使供應鏈管理順 E 化。

計畫目標：建設台灣成為台商及跨國企業設置區域營運總部的最佳地區。

(8) 全島運輸骨幹整建

策略：建設高速軌道運輸系統，提供快捷、準時安全的大眾運輸，包括完成高速鐵路及聯外道路、投資都會區捷運網，促進東部鐵路快速化；協助台鐵轉型再生，改造台鐵成為區域性的都會捷運；健全公路路網建設，包括補助地方公共交通、建伸/擴建高快速路網，形成便利完善的生活圈道路網。

計畫目標：投資大眾運輸，整合大眾交通服務，以提升台灣整體競爭力與強化運輸服務功能。

(9) 水與綠建設

策略：水資源合理規劃利用；地貌改造與復育；發展再生能源；推動污水下水道建設、綠營建計畫。

計畫目標：逐步恢復台灣的自然生態、創造亞熱帶國家生態島嶼典範。

(10) 新故鄉社區營造

策略：活化社區營造組織；社區營造資源整合；推動原住民新部落運動、新客家運動；發展醫療照顧服務社區化。

計畫目標：利用在地資源、引入人才及創意，營造活潑多彩的地方社區。



「挑戰 2008：國家發展重點計畫」分項計畫分年經費需求表(暫估數)單位：億元

建設項目	經費來源		分 年 經 費						91-96 年
			91 年	92 年	93 年	94 年	95 年	96 年	
1 E世代人才培育計畫	公務預算	中央	53.21	58.44	59.81	58.61	56.81	55.61	342.49
		地方	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	特種基金		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	民間投資		*	*	*	*	*	*	*
2 文化創意產業發展計畫	公務預算	中央	11.29	35.51	43.43	46.05	45.62	43.04	224.91
		地方	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	特種基金		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	民間投資		*	*	*	*	*	*	*
3 國際創新研發基地計畫	公務預算	中央	73.25	150.75	158.97	188.85	191.19	202.93	965.94
		地方	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	特種基金		64.95	128.32	133.95	130.91	133.43	84.93	676.49
	民間投資		3.63	12.68	18.23	32.41	47.28	44.62	158.86
4 產業高值化計畫	公務預算	中央	291.97	434.08	386.09	407.96	368.58	352.11	2,240.79
		地方	0.00	6.74	3.86	2.79	0.76	0.00	14.15
	特種基金		190.73	21.75	240.73	78.63	77.57	76.51	685.92
	民間投資		8.07	27.67	23.97	43.97	73.97	64.07	241.70
5 觀光客倍增計畫	公務預算	中央	72.28	161.31	139.99	135.89	121.22	126.42	757.11
		地方	0.15	0.00	0.00	0.00	0.00	0.00	0.15
	特種基金		15.58	16.07	14.40	14.50	14.50	15.50	90.55
	民間投資		*	*	*	*	*	*	*
6 數位台灣計畫	公務預算	中央	33.98	72.82	83.03	77.74	62.16	45.96	375.69
		地方	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	特種基金		0.30	0.00	0.00	0.00	0.00	0.00	0.30
	民間投資		671.79	621.85	596.32	611.89	636.09	506.08	3,644.02
7 營運總部計畫	公務預算	中央	1.95	11.36	23.95	33.39	33.64	23.90	128.18
		地方	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	特種基金		23.77	18.21	12.83	9.64	13.06	12.32	89.82
	民間投資		17.31	48.11	69.11	54.51	57.91	52.42	299.38
8 全島運輸骨幹整建計畫	公務預算	中央	543.58	874.15	1110.66	987.33	929.30	736.58	5,181.60
		地方	70.73	132.44	192.52	182.28	167.22	126.12	871.31
	特種基金		233.72	148.98	556.70	236.30	339.25	188.21	1,703.16
	民間投資		1705.25	1294.11	963.87	637.14	179.92	15.56	4795.85
9 水與綠建設計畫	公務預算	中央	143.28	297.26	321.66	438.54	484.77	510.66	2,196.16
		地方	51.60	43.64	43.94	44.34	44.88	46.21	274.61
	特種基金		6.50	72.67	70.05	8.80	10.00	10.60	178.62
	民間投資		*	5.30	7.70	21.85	24.15	22.50	81.50
10 新故鄉社區營造計畫	公務預算	中央	34.50	50.90	61.50	61.10	62.10	51.68	321.78
		地方	0.00	0.80	0.80	0.80	0.80	0.60	3.80
	特種基金		0.00	0.00	0.00	0.00	0.00	0.00	0.00
	民間投資		*	*	*	*	*	*	*

備註：「民間投資」係指公共建設計畫中屬BOT部分之民間出資款以及研究發展計畫之民間配合款，不包括各該計畫所帶動之民間投資金額；數位台灣計畫中民間投資為中華電信公司及三家民營固網業者之投資。



Part I. Microeconomics (each question 2 points): choose the best answer.

單選，答錯不倒扣

1. Moral hazard arises in disability insurance because

- A. There is adverse selection.
- B. It is difficult to check the truth of all claims.
- C. Offering insurance reduces the observed rate of disability claims.
- D. People buy too much insurance.

2. Suppose there are many firms selling a homogenous product X with four different prices (\$1,\$2,\$3,\$4) and each occurs with the same probability: 1 in 4. Each customer knows the probability distribution of possible prices. The marginal benefit of search for the customer who has only found a store with a price of \$4 is:

- A. \$0.
- B. \$0.25.
- C. \$1.50.
- D. \$2.75.

3. According to Walras' Law, if all markets but the corn market are in equilibrium

- A. corn prices are incorrect.
- B. The demand curve for corns is upward-sloping.
- C. The corn market must also be in equilibrium.
- D. The excess supply of corn market is positive.

4. Barbara and Rick have the utility function $U=XY$. Barbara has 50 units of X and 20 units of Y while Rick has an endowment of 20 units of X and 120 units of Y. What will be the competitive equilibrium, P_X/P_Y ?

- A. 2.
- B. 4.
- C. 6.
- D. 8.

5. Suppose there are five people considering construction of a new public park. Each one values the park at a certain amount (per year):

A	B	C	D	E
\$90	\$80	\$70	\$60	\$0

Suppose the park would cost each \$65 per year in added taxes, then

- A. the major voting results in a park.
- B. The median voter is D.
- C. The average voter is greater than the median voter.
- D. From a strict efficiency point of view, the park is necessary.



6. Which job would you prefer (interest rate, $r = 0.10$)?
- \$100,000 in year one and 110,000 in year 2.
 - \$50,000 in year one and 170,000 in year 2.
 - \$70,000 in year one and 130,000 in year 2.
 - \$60,000 in year one and 150,000 in year 2.
7. Consider the business of ditch digging, which uses labor and machines. The demand for ditches is given by $Q = 24 - 0.4P$. The two inputs L and M have marginal products $MP_L = 4 - 0.4L$ and $MP_M = 2 - 0.4M$, in the production process $Q = 4L + 2M - 0.2L^2 - 0.2M^2$. If labor costs \$90 per unit and machines \$16 per unit of time, how many units will be hired?
- $L=1$ and $M=3$.
 - $L=2$ and $M=2$.
 - $L=1$ and $M=2$.
 - $L=2$ and $M=3$.
8. Suppose the utility function is $U=CL$, where L is leisure. The worker's consumption is given by $C=\$5(12 - L)$, where 12 may be considered available hours. How many hours does she work?
- 6 hours.
 - 4 hours.
 - 8 hours.
 - 5 hours.
9. Which market in the following will have less price dispersion?
- Cars.
 - Soaps.
 - Toothpastes.
 - Apples.
10. If good A is a "neutral," what is its marginal rate of substitution for good B (which is normal)?
- Infinity.
 - 1.
 - 1.
 - 0.
11. When we assume that averages are preferred to extremes for a consumer, we mean his preference is
- Monotonic.
 - Convex.
 - Concave.
 - Neutral.



12. On a certain island there are only two goods, wheat and milk. The only scarce resource is land. There are 1000 acres of land. An acre of land will produce either 16 units of milk or 37 units of wheat. The citizens of this island all have utility functions of the form $U(M,W)=MW$. At every Pareto optimal allocation,

- A. The number of units of milk produced equals the number of units of wheat produced.
- B. Total milk production is 800.
- C. All citizens consume the same commodity bundle.
- D. Every consumer's marginal rate of substitution between milk and wheat is -1 .

13. The town of Brass Monkey has population 500. Brass Monkey has a single public good, the town skating rink and a single private good, Labatt's ale.

Everyone's utility function is $U_i(X_i, Y) = X_i - 64/Y$, where X_i is the number of bottles of ale consumed by i and Y is the size of the skating rink in square meters. The price of ale is \$1 per bottle. The cost of skating rink to the city is \$5 per square meter. Everyone has income of at least \$5000. What is the Pareto efficient size for the town skating rink?

- A. 80 square meters.
- B. 200 square meters.
- C. 100 square meters.
- D. 165 square meters.

14. If you have an income of \$12 to spend, if commodity 1 costs \$2 per unit, and if commodity 2 costs \$6 per unit, then the equation for your budget line can be written as

- A. $X_1/2 + X_2/6 = 12$.
- B. $(X_1 + X_2)/(8) = 12$.
- C. $X_1 + 3X_2 = 6$.
- D. $8(X_1 + X_2) = 12$.

15. Charlie's indifference curves have the equation $X_B = \text{constant}/X_A$, where larger constants correspond to better indifference curves. Charlie strictly prefers the bundle (7,15) to the following bundle

- A. (15,7).
- B. (8,14).
- C. (11,11).
- D. (10,10).



16. Mary measures the departure of any bundle from her favorite bundle by the sum of the absolute values of the differences. Her favorite bundle is (2,7), that is, 2 cookies and 7 glasses of milk. Mary's indifference curve that passes through the point (c,m)=(3,6) also passes through

- A. (4,5).
- B. The points (2,5), (4,7), and (3,8).
- C. (2,7).
- D. The points (3,7), (2,6), and (2,8).

17. Ambrose has the utility function $U(X_1, X_2) = 4X_1^{1/2} + X_2$. If Ambrose were initially consuming 81 units of nuts and 14 units of berries, then what is the largest number of berries that he would be willing to give up in return for an additional 40 units of nuts.

- A. 11.
- B. 25.
- C. 8.
- D. 4.

18. Elmer's utility function is $U(X, Y) = \min\{X, Y^2\}$. If the price of X is 15, the price of Y is 10, and Elmer chooses to consume 7 units of Y, what must Elmer's income be?

- A. 1610.
- B. 175.
- C. 905.
- D. 805.

19. Bartholomew has a utility function $U(X_1, X_2) = 8X_1^{1/2} + X_2$. His income is 23, the price of nuts is 2 and the price of berries is 1. How many units of berries will Bartholomew demand?

- A. 15.
- B. 4.
- C. 30.
- D. 10.

20. If Abishag owned 9 quinces and 10 kumquats, and if the price of kumquats is 3 times the price of quinces, how many kumquats could she afford if she spent all of her money on kumquats?

- A. 26.
- B. 19.
- C. 10.
- D. 13.



21. A consumer has the utility function $U(C_1, C_2) = C_1 C_2$. There is no inflation, the interest rate is 10%, and the consumer has income 100 in period 1 and 121 in period 2.

The optimal intertemporal choice is

- A. $C_1=105, C_2=120$.
- B. $C_1=106, C_2=110$.
- C. $C_1=105, C_2=115.5$.
- D. $C_1=100, C_2=125$.

22. Let the production function be $f(x_1, x_2) = \min\{x_1, x_2\}$. It follows that the production function has

- A. Increasing return to scale.
- B. Constant return to scale.
- C. Decreasing return to scale.
- D. Diminishing return.

23. A firm has the production function $f(x_1, x_2) = x_1^{1/2} x_2^{1/2}$. Suppose that this firm is using 16 units of factor 2 and is unable to vary this quantity in the short run. Let the price of the firm's output be p , and let the price it pays per unit of factor 1 be w_1 .

What is the optimal income level of x_1 ?

- A. $(2p/w_1)^{1/2}$.
- B. $(2p/w_1)^2$.
- C. $(2p/w_1)^{1/3}$.
- D. $(2p/w_1)^{1/4}$.

24. A firm has the production function $f(x_1, x_2) = (\sqrt{x_1} + 3\sqrt{x_2})^2$. The price of factor 1 is $w_1=1$ and the price of factor 2 is $w_2=1$. What is the cheapest cost to produce 16 units of output?

- A. 2.5. B. 4.0.
- C. 1.5. D. 1.6.

25. A parent has two children living in cities with different costs of living. The cost of living in city B is 3 times the cost of living in city A. The child in city A has an income \$3000 and the child in city B has an income of \$9000. The parent wants to give a total of \$4000 to her two children. Her utility function is $U(C_A, C_B) = C_A C_B$, where C_A and C_B are the consumptions of the children living in cities A and B respectively. She will choose to

- A. give each child \$2000.
- B. Give the child in city B 3 times as much money as the child in city A.
- C. Give the child in city A 3 times as much money as the child in city B.
- D. Give the child in city B 1.5 times as much money as the child in city A.



Part II. Macroeconomics (2.5 points for each question): choose the best answer

26. Assume that each apple costs \$0.5 in 1992 and \$1 in 1997, while each orange costs \$1 in 1992 and \$1.5 in 1997. If 4 apples were produced in 1992 and 5 in 1997, while 3 oranges were produced in 1992 and 5 in 1997, then the GDP deflator in 1997, using a base year of 1992, was approximately:

- (A) 1.5
- (B) 1.7
- (C) 1.9
- (D) 2.0

27. In a given month in the United States, 100 million people are working, 10 million are not working but are looking for work, and 20 million are not working and have given up looking for work. The official unemployment rate is

- (A) 7.7%
- (B) 9.1%
- (C) 10%
- (D) 23%

28. The Pigou Effect:

- (A) suggests that as prices fall and real money balances rise, consumers should feel less wealthy and spend less.
- (B) suggests that as prices fall and real money balances rise, consumers should feel wealthier and spend more.
- (C) suggests that as prices fall and real money balances fall, consumers should feel less wealthy and spend less.
- (D) suggests that as prices fall and real money balances fall, consumers should feel wealthier and spend more.

29. If the investment demand function is $I = c - dr$ and the quantity of real money demanded is $M^d = eY - fr$, where c , d , e , and f are constant, then monetary policy (compared to fiscal policy) is relatively potent in influencing aggregate demand when:

- (A) d is large and f is small.
- (B) d is small and f is also small.
- (C) d is small and f is large.
- (D) d is large and f is also large.



30. The relationship between short-run aggregate supply curves and Phillips curves is that there:
- (A) is no relationship between short-run aggregate supply curves and Phillips curves.
 - (B) are several short-run aggregate supply curves for each Phillips curve.
 - (C) are several Phillips curves for each short-run aggregate supply curve.
 - (D) is exactly one Phillips curve corresponding to each short-run aggregate supply curve.
31. Assume that an economy has the Phillips curve $\pi_t = \pi_{t-1} - 0.5(u_t - 0.06)$, where π_t and u_t respectively are the rate of inflation and the rate of unemployment at time t . The natural rate of unemployment is:
- (A) 0.5
 - (B) 0.12
 - (C) 0.06
 - (D) 0.03
32. The Lucas critique argues that because the way people form expectation is based _____ on government policies, economists _____ predict the effect of a change in policy without taking changing expectations into account.
- (A) partly; cannot
 - (B) only partly; can
 - (C) in no way; can
 - (D) in no way; cannot
33. The Golden Rule level of capital accumulation tells how to find the steady state with the highest level of:
- (A) output per worker
 - (B) capital per worker
 - (C) savings per worker
 - (D) consumption per worker
34. Assume that interest parity holds. If the U.S. interest rate is 5% while the German interest rate is 7%, then the deutschemark is expected to:
- (A) depreciate by 12%.
 - (B) depreciate by 2%.
 - (C) appreciate by 2%.
 - (D) appreciate by 12%.



35. Assume that the production function of an economy is $Y = AK^{0.5}L^{0.5}$, where Y , A , K , and L are respectively output, technology, physical capital, and labor. If A , K , and L are all 100, then the marginal production of physical capital is:
- (A) 50
 (B) 100
 (C) 200
 (D) 1000
36. Assume that the per-worker production function is given by $y = k^{1/2}$, where y is per-worker output and k is ratio of capital to labor. If the saving rate is 0.2 and the capital depreciation rate is 0.1, then the steady-state ratio of capital to labor is:
- (A) 1
 (B) 2
 (C) 4
 (D) 9
37. Fluctuations in output in the short run are the result of changes in _____ according to the real-business-cycle theory and the result of changes in _____ according to new Keynesian economics.
- (A) aggregate demand; aggregate demand
 (B) the natural rate of output; the natural rate of output
 (C) aggregate demand; the natural rate of output
 (D) the natural rate of output; aggregate demand
38. Total factor productivity may be measured by:
- (A) subtracting the rate of growth of capital input and the rate of growth of labor input from the rate of growth of output.
 (B) subtracting the rate of growth of capital input, multiplied by capital's share of output, plus the rate of growth of labor input, multiplied by labor's share of output, from the rate of growth of output:
 (C) adding the rate of growth of capital input to the rate of growth of labor input.
 (D) adding the rate of growth of capital input, multiplied by capital's share of output, to the rate of growth of labor input, multiplied by labor's share of output.



39. According to recent new growth theories, what is probably most important to worldwide output growth?
- (A) an increase of saving rates.
 - (B) an increase of the accumulation of physical capital.
 - (C) an increase of the accumulation of knowledge.
 - (D) an increase of population.
40. According to recent new growth theories, what is probably central to explain the cross-country differences of income per person?
- (A) differences in saving rates across countries.
 - (B) differences in institutions and policies (or named in social infrastructure) across countries.
 - (C) differences in population across countries.
 - (D) differences in depreciation rates of physical capital across countries.
41. If Fed A cares only about keeping the price level stable and Fed B cares only about keeping output at its natural level, then in response to an exogenous increase in the price of oil:
- (A) both Fed A and B should increase the quantity of money.
 - (B) Fed A should increase the quantity of money while Fed B should keep it stable.
 - (C) Fed A should keep the quantity of money stable while Fed B should increase it.
 - (D) both Fed A and B should keep the quantity of money stable.
42. In a small open economy with a floating exchange rate, if the government adopts an expansionary fiscal policy, in the new short-run equilibrium:
- (A) income and the exchange rate will both rise.
 - (B) the exchange rate will rise, but income will remain unchanged.
 - (C) income will rise, but the exchange rate will remain unchanged.
 - (D) both income and the interest rate will rise.
43. In Irving Fisher's two period consumption model, if the income of period one $Y_1 = 20,000$, the income of period two $Y_2 = 15,000$, and the interest rate is 50%, the maximum possible consumption in period two is:
- (A) 15,000
 - (B) 25,000
 - (C) 35,000
 - (D) 45,000



44. If Tobin's q is greater than one, managers should:

- (A) increase the capital stock of the firm.
- (B) maintain the existing capital stock of the firm.
- (C) allow inventories to run down.
- (D) decrease the capital stock of the firm.

45. If the monetary base is denoted by B , rr is the ratio of reserves to deposits, and cr is the ratio of currency to deposit, then the money supply is equal to _____ divided by _____ multiplied by B .

- (A) $(rr + 1)$; $(rr + cr)$
- (B) $(cr + 1)$; $(rr + cr)$
- (C) $(rr + cr)$; $(rr + 1)$
- (D) $(rr + cr)$; $(cr + 1)$