



分析與推理

每題 25 分

答題不須冗長，儘可能運用流程圖、結構圖、表單等來凸顯答題之重點。

1. 宅配或快遞公司需有一及時派車系統，以便有效的控管其車輛。現假設有五十部車。每天出門時，每部車的目的地及裝載都已確定，亦即行程是確定的。但所有車輛出門後，控管中心尚會接到顧客的送貨要求。因此每部車在出門時的原有行程，都可能受到更改。理論上，若有一定位系統，因此在電子地圖可查知五十部車的位置。一旦接到顧客新的送貨要求，便可派出距離顧客最近而且裝載尚有空間之車輛前去顧客的地點取貨。問題是，在控管中心內，若有很多顧客在很短時間內送進很多的送貨要求。即使每部車都有很好的通訊設備，可以隨時接收到修訂的行程。但要依顧客要求去指揮五十部車前去許多不同的顧客地點取貨，則不是控管人員看著電子地圖就能做到的。控管中心會須要一個電腦化的決策系統，亦即及時派車系統之中樞。請規劃此一系統，並假設在控管中心及車輛上所須之設備及其功能。
2. 有一廚師需用一口爐子，做十二道菜。廚師希望能以最短時間完成這十二道菜，但無論這十二道菜的加工順序，每道菜所須之加工時間是固定的。因此有助於縮短完成時間，僅是使兩道菜之間的洗鍋時間最小化。比如，煎了魚再炒青菜，則需較長之洗鍋時間。但若順序到過來，先炒青菜，再煎魚，則其之間的洗鍋時間會較短。試問這是那一種問題，如何求解答案？
3. Consider a **real** production planning problem. You are given demands (real and forecasted) for each product for the next four weeks and an LP software package. You are asked to provide a production plan for each product for the next 4 weeks. Describe
 - (a) What other information and data you will collect in order to come up a production plan?
 - (b) How will you use the collected information and data to set up an LP model?
 - (c) What are the assumptions you made in setting up the model?
 - (d) After solving the LP model with the software package provided, how do you use the information obtained from the LP software to manage the production system?



4. 藉由電腦、通訊等科技之提昇，私家轎車智慧化已為國內、外各大車廠競相努力研發之議題；其目的為建立一完整之行車資訊系統置於車內，於適當時機提供駕駛者正確之相關行車資訊，使駕駛者能於任何道路、時間狀況下安全而有效的到達目的地。

現有一大車廠有意開發符合上述目的之智慧型資訊系統，且決定該系統包含：導航，安全警告，交通規則提示，與生活休閒等四大功能。請針對其中一項功能，回答下列問題。

- (a) 請說明：你將如何界定、執行、歸納出該功能中駕駛者所需之資訊內容為何？
- (b) 該大車廠有意藉由軍事科技中之抬頭顯示器（可將所欲提供駕駛者之資訊投射至駕駛者前方之擋風玻璃上），作為呈現問題(a)中你所發現之各項資訊。請問：基於行車安全之前提下，哪些因素將是你考量作為選取問題(a)中之適合投射於抬頭顯示器上之資訊項目？
- (c) 若該抬頭顯示器呈現之面積為40cm（長）x20cm（寬）。請問：問題(b)中你所選出之資訊應如何安排於該顯示器上（包括：考慮因素與運用方法）？
- (d) 恭喜你完成問題(a)至(c)，表示你已有能力為該大車廠規劃、設計合適之智慧型車內資訊系統！現在該大車廠面臨將該系統量產前之測試問題，希望你能提出一適合之實驗設計安排，藉已評估你所建議之系統是否對不同屬性之消費族群均能確保其安全與滿意。請詳細說明你實驗中之自變數，依變數，實驗程序之安排，與如何分析、檢驗所得之數據。



一、解釋與簡答下列名詞 (每題 5 分)

- (1) QFD
- (2) Value Analysis
- (3) TPM
- (4) Cross-Docking
- (5) Blanket Order
- (6) Lean Production
- (7) ISO9000 文件架構
- (8) Kaizen

二、某公司某產品 3 年一月到十二月銷售量如下表所示，請問您將使用何方法來預測下一年前三個月(1-3 月)之銷售量？您將如何來驗證此方法之正確性？(15%)

年\月	1	2	3	4	5	6	7	8	9	10	11	12
1	1991	1676	2723	3565	4688	5086	5621	5428	4383	3433	2743	1843
2	2109	2032	2651	3323	4663	4704	6010	5616	4235	3753	3056	2187
3	2216	2496	2765	3748	5067	5195	6026	5513	4440	3152	2460	2408

三、某工廠生產 X 產品所需作業與其作業時間及前置作業如下表所示，茲假設週期時間盡可能最小，試計算其最少工作站數，實際工作站數，並依後續作業數目最多優先法則求每一工作站之作業項目與生產線平衡之效率。(15%)

作業	作業時間(分)	前置作業
A	0.2	--
B	0.4	A
C	0.3	--
D	1.3	B, C
E	0.1	--
F	0.8	E
G	0.3	D, F
H	1.2	G



四、公司因業務量增加而考慮擴充產能，其考慮方案有三：(A)設新廠，(B)外包，(C)擴充現有生產線。A 方案每年須投入固定成本\$250,000，每單位變動成本為\$500。B 方案每單位變動成本為\$2,500。C 方案每年須投入固定成本\$50,000，每單位變動成本為\$1,000。試問各方案在何需求量下最適合採用？當需求量為 100 單位時，何方案最佳？(15%)

五、某工作站六個訂單之作業時間與交期如下表所示(依 FCFS 順序)，試以 FCFS, SPT, CR 等法則，求其工作順序與所得之平均流程時間與平均延遲時間。(15%)

訂單	作業時間(天)	交期(天)
A	3.5	7
B	2.0	6
C	4.5	18
D	5.0	22
E	2.5	4
F	6.0	20



- 1.(1) List five usual steps of an OR study (5%).
 (2) Point out at least three major difficulties for you to use Linear Programming to optimize your life planning (Hint. Think about your objectives and the constraints.) (6%).
 (3) 某公司有四個工廠分別位於新竹、南投、台南、台東。這些工廠生產出來的產品需經由卡車運往台北、台中、嘉義、高雄四個配銷中心，以利配銷至附近的各個零售點。四個工廠每週的產能分別為 300、150、420、240 單位。四個配銷中心每週的需求則分別為 400、320、180、210 單位。各工廠與各配銷中心間每單位的運輸成本如下圖所示。

例如：由新竹至台北的單位運輸成本為\$60，台東至高雄則不適宜運送。

		配銷中心				供給
		台北	台中	嘉義	高雄	
工廠	新竹	60	80	160	240	300
	南投	170	30	80	180	150
	台南	230	170	90	30	420
	台東	270	200	180	--	240
需求		400	320	180	210	

- (a) 請問在此問題中有幾個基變數？(2%)
 (b) 請找出起始解（用西北角法）。(4%)
 (c) 及下一組較佳解（請清楚列出過程）。(8%)

$$\begin{aligned}
 & 2. \text{Minimize} && 2X_1 + 3X_2 \\
 & \text{Subject to} && X_2 \geq 2 \\
 & && 4X_1 + 3X_2 \geq 12 \\
 & && X_1 + 2X_2 \leq 8 \\
 & && X_1, X_2 \geq 0
 \end{aligned}$$

- (1) Solve this problem graphically. (10%)
 (2) Change the constraint $X_1 + 2X_2 \leq 8$ to $X_1 + 2X_2 \leq A$. Discuss how the value of A would influence the optimal solution. (Consider all possible values of A as a real number). (8%)
 (3) Use the Simplex Method to find the initial solution. (7%)



3. A new motorcycle has 3 wheels: the front wheel, the rear wheel and the spare wheel. In a regular riding, spare wheel is not used. The life time for the front wheel is exponential with rate μ_1 , and for the rear wheel is exponential with rate μ_2 and for the spare wheel is exponential with rate μ_3 . When one of the operating wheel fails, it is immediately replaced by the spare wheel. The motorcycle is declared unusable when more than two wheels failed.
- (a) Find the probability that front wheel is the second wheel that failed (9%)
 - (b) Find the probability that spare wheel is the second wheel that failed (8%)
 - (c) Find the expected time till the declaration that the motorcycle is unusable. (8%)
4. Consider the following service system. The arrival process is a Poisson process with rate α , the service time for each customer is exponential with rate μ . The server wait until 3 customers are present before beginning service on the first customer; thereafter, he services one at a time until all and all subsequent customers until all 3 customers, and all subsequent customers are serviced. The server is then idle until queue of size 3 is formed again.
- (a) Define the appropriate state for the system, and draw the transition rate diagram. (15%)
 - (b) Set up the balance equations (10%)



每題10分,共10題。請詳列計算過程。

- 1) 求 $\lim_{x \rightarrow \infty} (1 + \frac{2}{2} + \frac{3}{2^2} + \dots + \frac{n}{2^{n-1}}) = ?$
- 2) 求 $f(x, y) = x^3 + y^2 + 2xy - 4x - 3y + 5$ 的所有相對極值
- 3) 利用梯度去求出 $f(x, y) = x^2 - 4xy$ 在 $P(1, 2)$ 點上, 從 $P(1, 2)$ 點到 $Q(2, 5)$ 點的方向導數
- 4) 求拋物線 $y = x^2$ 上的點到點 $(3, 0)$ 最近者
- 5) 求曲線 $6xy - y^4 - 3 = 0$ 從點 $(\frac{19}{12}, 2)$ 到點 $(\frac{14}{3}, 3)$ 的曲線長度
- 6) If $A = (a_{ij})_{n \times n}$ is a nilpotent matrix (冪零方陣) of degree k , show that $I - A$ is non-singular (可逆方陣) .
- 7) If $M = \begin{bmatrix} 2 & 2 & 2 \\ 2 & 3 & 1 \\ 2 & 1 & 3 \end{bmatrix}$, is M a positive-definite (恆正) matrix ?
- 8) If $W = \{(1, 1, 2), (1, 2, 3)\}$, find the orthogonal complement (正交互餘空間) of W .
- 9) If T is a linear transform from a n -dimensional vector space into it-self, show that T is one-to-one (一對一) if and only if T is onto (映成) .
- 10) If $b(n+1) = b(n) + b(n-1)$, $n \geq 1$ with $b(0) = 0$, $b(1) = 1$, find the general solutions (一般解) .



一、供應鏈競爭規劃(50%)

e 世代的產業競爭，不分業種與業態，不分服務業或製造業，例如台大醫院與榮民總醫院、台積電與聯電、7/11 與萊爾富、大榮貨運與新竹貨運等，皆已經由個別企業間之競爭，演進成為其所在供應鏈與其競爭對手所在之供應鏈間的戰爭。唯有整體供應鏈能存活，產業個體才會有存活之空間。請針對您所熟悉之產業，規劃競爭對策：

1. 基本資料說明(5%)：

- (1) 描繪本身企業所在之供應鏈結構與特性。
- (2) 描繪競爭對手企業所在之供應鏈結構與特性。
- (3) 說明本身企業之特性。
- (4) 說明競爭對手企業之特性。

2. 規劃本身企業之競爭對策(35%)：

參考規劃方向：

- (1) 依短程、中程、長程。
- (2) 依策略面、管理面、作業面。
- (3) 依產品、服務。
- (4) 其他。

3. 說明如何評估所擬對策之可行性與正確性 (10%)。

二、二十一世紀全球各行各業的經營環境無不快速變遷，您認為是哪些因素導致這樣的變遷？又就您的觀察，各行各業共有的經營環境有哪些改變？(15%)

三、ABC 公司是一家擁有約 500 名員工的企業，長久以來，該公司較注重專業技術的研發或改良，而比較忽略管理的教育訓練或管理活動的推行。由於環境的快速改變，ABC 公司不得不在管理上有所突破。由於您是這家公司的資深部門主管，平時即不斷的閱讀管理新知，並經常參加公司外有關管理方面的進修，因此被公司賦予擬定一份五年管理活動推行企劃書的重責。試在有限的時間內儘可能的呈現這一份符合 ABC 公司需求的企劃書。(35%)

[註]：您可假設您這家企業的經營背景，如製造業或服務業，其目前所遭遇的困境等。

- 切勿將您的真實姓名、您所服務的機構名稱或單位明示或暗示的呈現出來。



選擇題在答案卷第一頁依序標明題次及答案，問答證明題從第二頁開始依序作答

I. Multiple-choice questions:

1. (5%) Assume $\Pr(A) = 0.3, \Pr(B | A) = 0.75, \Pr(B | A^c) = 0.2, \Pr(C | A \cap B) = 0.2,$
 $\Pr(C | A^c \cap B) = 0.15, \Pr(C | A \cap B^c) = 0.8, \Pr(C | A^c \cap B^c) = 0.9.$ What is $\Pr(C)$? (a)0.60 (b)0.63
 (c)0.66 (d)0.69 (e) else.
2. (5%) If $E(X) = 17$ and $E(X^2) = 298$, which one of the following answers is the lower bound for $\Pr(10 < X < 24)$ using Chebyshev's inequality. (a) 9/49 (b) 8/9 (c) 40/49 (d) 21/25 (e) else.
3. (5%) Suppose that there are 12 songs on a compact disk of which two are your favorites. When using the random button selector on a CD player, each of the 12 selections is played once in a random order. What is the probability that the second of your two favorites is the third song that is played? (a) 1/33 (b) 1/66 (c) 2/33 (d) 1/22 (e) else.
4. (5%) Suppose random variables X and Y have the joint probability density function:
 $f(x, y) = 8xy, 0 < x < y < 1.$ What is the covariance between X and Y ? (a)0.40 (b)0.42 (c)0.44 (d)0.46
 (e) else.
5. (5%) A milling machine breaks down according to a Poisson process with an average 5 times a year. What is the probability that the second breakdown will take place in 3 months? (a)0.36 (b)0.40
 (c)0.44 (d)0.48 (e) else.
6. (5%) A random sample: 2, 1, 2, 5, 2, 10, 5, 7, 9, 2, 1, 5 is taken from the following discrete distribution: $f(x; p) = q^{x-1} p, x = 1, 2, \dots,$ where $q = 1 - p.$ What is the maximum likelihood estimate of the distribution parameter p ? (a)0.32 (b)0.34 (c)0.36 (d)0.38 (e) else.
7. (5%) For a public opinion poll for a close presidential election, let p denote the proportion of voters who favor candidate A. How large a sample should be taken if we want the maximum error of the estimate of p to be equal to 0.03 with 95% confidence? (a) 1067 (b) 1068 (c) 1069 (d) 1070 (e) else.
8. (5%) To compare the mean admission test scores of applicants from two different areas, independent random samples of $n_1 = 15$ rural applicants and $n_2 = 17$ urban applicants were selected. Their results were $\bar{x}_1 = 495, s_1 = 55$ and $\bar{x}_2 = 545, s_2 = 50.$ Assuming both populations are normally distributed with means μ_1 and μ_2 , respectively, and equal variance, a 95% confidence interval for $\mu_2 - \mu_1$ is (a) (19.1, 80.9) (b) (18.5, 81.5) (c) (18.5, 87.9) (d) (12.1, 87.9) (e) else.



9. (5%) In a quality inspection, 2 defects are found in 12 random samples. An *exact* binomial test is used to test whether the defect percent is larger than 0.1. What is the p-value of this test? (a)0.32 (b)0.34 (c)0.36 (d)0.38 (e) else.
10. (5%) A random sample is observed as the following: 23.0, 9.0, 2.3, 11.4, 14.1, 9.4, 0.5, 14.6, 17.5, 3.6, 1.8, 5.6, 22.7, 6.6, 11.5. A χ^2 test is used to check if the observations are exponentially distributed. What is the p value of the test? (a)between 0.5 and 0.7 (b)between 0.3 and 0.5 (c)between 0.25 and 0.3 (d)between 0.2 and 0.25 (e) else.

II. Interpretation and proof questions

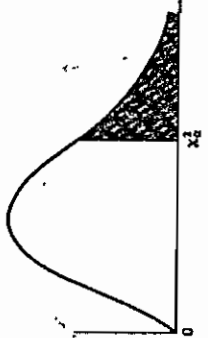
1. (10%) Explain the following briefly:

- (1) Random sampling
- (2) Confidence coefficient
- (3) Significance level
- (4) Alternative and Null hypotheses
- (5) The correspondence between interval-estimation and hypotheses testing

2. (10%) To have a good approximation when we use the normal distribution to approximate the binomial distribution with parameters n and p , the general rule of $np \geq 5$ and $n(1-p) \geq 5$ has to be satisfied. Explain the reason why.

3. (15%) Let X_1, X_2, X_3 be mutually independent random variables with Poisson distributions having means μ_1, μ_2, μ_3 , respectively. If $Y = X_1 + X_2 + X_3$, show that Y is also a Poisson distribution with mean $\mu_1 + \mu_2 + \mu_3$.

4. (15%) A linear regression model is hypothesized as the following: $Y_i = \alpha + \beta x_i + e_i$, $i = 1, 2, \dots, n$, where Y_i 's are the responses, x 's are the predictors, and e_i 's are i.i.d. normal random errors with mean 0 and variance σ^2 . Let $B = \frac{\sum_{i=1}^n (x_i - \bar{x})(Y_i - \bar{Y})}{\sum_{i=1}^n (x_i - \bar{x})^2}$ be the least squares estimators of β , derive the sampling distribution of B in details.



(continued) Critical Values of the Chi-Squared Distribution

v	α									
	.30	.25	.20	.10	.05	.025	.02	.01	.005	.001
1	1.074	1.323	1.642	2.706	3.841	5.024	5.412	6.635	7.879	10.827
2	2.408	2.773	3.219	4.605	5.991	7.378	7.824	9.210	10.597	13.815
3	3.665	4.108	4.642	6.251	7.815	9.348	9.837	11.345	12.838	16.268
4	4.878	5.385	5.989	7.779	9.488	11.143	11.668	13.277	14.860	18.465
5	6.064	6.626	7.289	9.236	11.070	12.832	13.388	15.086	16.750	20.317
6	7.231	7.841	8.558	10.645	12.592	14.449	15.033	16.812	18.548	22.457
7	8.393	9.037	9.803	12.017	14.067	16.013	16.622	18.475	20.378	24.322
8	9.524	10.219	11.030	13.362	15.507	17.535	18.168	20.090	21.955	26.125
9	10.656	11.389	12.242	14.684	16.919	19.023	19.679	21.466	23.589	27.877
10	11.781	12.549	13.442	15.987	18.307	20.483	21.161	23.029	25.188	29.588
11	12.899	13.701	14.631	17.275	19.675	21.920	22.618	24.725	26.757	31.264
12	14.011	14.845	15.812	18.549	21.026	23.337	24.034	26.217	28.300	32.909
13	15.119	15.984	16.985	19.812	22.362	24.736	25.472	27.688	29.819	34.578
14	16.222	17.117	18.151	21.064	23.685	26.119	26.873	29.141	31.319	36.123
15	17.322	18.245	19.311	22.307	24.996	27.488	28.239	30.578	32.801	37.697
16	18.418	19.369	20.465	23.542	26.296	28.845	29.633	32.000	34.267	39.252
17	19.511	20.489	21.615	24.769	27.587	30.191	30.995	33.09	35.718	40.790
18	20.601	21.605	22.760	25.989	28.869	31.526	32.346	34.805	37.156	42.312
19	21.689	22.718	23.900	27.204	30.144	32.852	33.687	36.191	38.582	43.820
20	22.775	23.828	25.038	28.412	31.410	34.170	35.020	37.566	39.997	45.315
21	23.858	24.935	26.171	29.615	32.671	35.479	36.343	38.932	41.401	46.797
22	24.939	26.039	27.301	30.813	33.924	36.781	37.639	40.289	42.796	48.268
23	26.018	27.141	28.429	32.007	35.172	38.076	38.968	41.438	44.181	49.728
24	27.096	28.241	29.553	33.196	36.415	39.364	40.270	42.800	45.558	51.179
25	28.172	29.339	30.675	34.382	37.652	40.646	41.566	44.114	46.928	52.620
26	29.246	30.434	31.795	35.563	38.885	41.923	42.856	45.442	48.290	54.072
27	30.319	31.528	32.912	36.741	40.113	43.194	44.140	46.363	49.645	55.476
28	31.391	32.620	34.027	37.916	41.337	44.461	45.119	47.288	50.993	56.893
29	32.461	33.711	35.139	39.087	42.557	45.722	46.693	48.288	52.336	58.302
30	33.530	34.800	36.250	40.256	43.773	46.979	47.962	49.392	53.672	59.703

Critical Values of the Chi-Squared Distribution α

v	α									
	.995	.99	.98	.975	.95	.90	.80	.75	.70	.50
1	0.0001	0.001	0.002	0.003	0.005	0.010	0.020	0.030	0.040	0.100
2	0.010	0.020	0.030	0.040	0.050	0.100	0.150	0.200	0.250	0.500
3	0.071	0.115	0.149	0.185	0.216	0.352	0.454	0.562	0.675	1.386
4	0.207	0.297	0.375	0.457	0.538	0.854	1.064	1.273	1.479	3.357
5	0.412	0.554	0.675	0.811	0.935	1.610	2.004	2.365	2.708	6.626
6	0.676	0.872	1.034	1.237	1.435	2.204	2.707	3.159	3.598	9.348
7	0.989	1.239	1.464	1.690	1.917	2.833	3.432	3.983	4.517	12.592
8	1.344	1.646	1.932	2.218	2.493	3.490	4.204	4.867	5.517	16.013
9	1.735	2.088	2.422	2.760	3.075	4.168	5.000	5.789	6.571	19.023
10	2.156	2.558	2.939	3.247	3.540	4.865	5.817	6.737	7.615	22.457
11	2.603	3.053	3.469	3.816	4.117	5.578	6.641	7.684	8.641	26.125
12	3.074	3.571	4.018	4.404	4.726	6.304	7.467	8.634	9.621	29.812
13	3.565	4.107	4.585	5.009	5.329	6.942	8.054	9.299	10.311	33.900
14	4.075	4.660	5.168	5.529	5.851	7.500	8.667	9.951	11.016	38.151
15	4.601	5.229	5.785	6.262	6.561	8.047	9.307	10.716	11.816	42.567
16	5.142	5.812	6.354	6.908	7.212	8.547	10.007	11.524	12.616	47.156
17	5.697	6.408	6.975	7.564	7.872	9.085	10.752	12.381	13.421	51.923
18	6.265	7.015	7.596	8.231	8.590	9.665	11.524	13.288	14.241	56.779
19	6.844	7.633	8.267	8.907	9.307	10.311	12.316	14.241	15.075	61.779
20	7.434	8.260	8.921	9.591	10.011	11.011	13.281	15.172	15.923	66.909
21	8.034	8.897	9.591	10.283	10.711	11.711	14.241	16.123	16.791	72.156
22	8.643	9.542	10.283	10.982	11.411	12.411	15.172	17.075	17.661	77.579
23	9.260	10.196	10.982	11.253	12.111	13.111	16.123	18.027	18.531	83.156
24	9.886	10.856	11.682	11.992	12.811	13.811	17.075	19.023	19.401	88.779
25	10.520	11.524	12.381	12.679	13.511	14.511	18.027	20.011	20.271	94.523
26	11.160	12.198	13.041	13.444	14.211	15.211	19.023	21.011	21.141	100.379
27	11.808	12.879	13.721	14.125	14.911	15.911	20.011	22.011	22.011	106.356
28	12.461	13.565	14.407	14.847	15.611	16.611	21.011	23.011	22.881	112.441
29	13.121	14.256	15.092	15.574	16.311	17.311	22.011	24.011	23.751	118.631
30	13.787	14.953	15.766	16.271	17.011	18.011	23.011	25.011	24.621	124.921



(continued) Critical Values of the F-Distribution

$f_{\alpha}(v_1, v_2)$

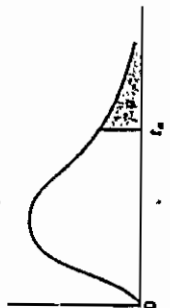
v_2	v_1										
	10	12	15	20	24	30	40	60	120	∞	
1	241.9	243.9	245.9	248.0	249.1	250.1	251.1	252.2	253.3	254.3	
2	19.40	19.41	19.43	19.45	19.45	19.46	19.47	19.48	19.49	19.50	
3	8.79	8.74	8.70	8.66	8.64	8.62	8.59	8.57	8.55	8.53	
4	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69	5.66	5.63	
5	4.74	4.68	4.62	4.56	4.53	4.50	4.46	4.43	4.40	4.36	
6	4.06	4.00	3.94	3.87	3.84	3.81	3.77	3.74	3.70	3.67	
7	3.64	3.57	3.51	3.44	3.41	3.38	3.34	3.30	3.27	3.23	
8	3.35	3.28	3.22	3.15	3.12	3.08	3.04	3.01	2.97	2.93	
9	3.14	3.07	3.01	2.94	2.90	2.86	2.83	2.79	2.75	2.71	
10	2.98	2.91	2.85	2.77	2.74	2.70	2.66	2.62	2.58	2.54	
11	2.85	2.79	2.72	2.65	2.61	2.57	2.53	2.49	2.45	2.40	
12	2.75	2.69	2.62	2.54	2.51	2.47	2.43	2.38	2.34	2.30	
13	2.67	2.60	2.53	2.46	2.42	2.38	2.34	2.30	2.25	2.21	
14	2.60	2.53	2.46	2.39	2.35	2.31	2.27	2.22	2.18	2.13	
15	2.54	2.48	2.40	2.33	2.29	2.25	2.20	2.16	2.11	2.07	
16	2.49	2.42	2.35	2.28	2.24	2.19	2.15	2.11	2.06	2.01	
17	2.45	2.38	2.31	2.23	2.19	2.15	2.10	2.06	2.01	1.96	
18	2.41	2.34	2.27	2.19	2.15	2.11	2.06	2.02	1.97	1.92	
19	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98	1.93	1.88	
20	2.35	2.28	2.20	2.12	2.08	2.04	1.99	1.95	1.90	1.84	
21	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92	1.87	1.81	
22	2.30	2.23	2.15	2.07	2.03	1.98	1.94	1.89	1.84	1.78	
23	2.27	2.20	2.13	2.05	2.01	1.96	1.91	1.86	1.81	1.76	
24	2.25	2.18	2.11	2.03	1.98	1.94	1.89	1.84	1.79	1.73	
25	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82	1.77	1.71	
26	2.22	2.15	2.07	1.99	1.95	1.90	1.85	1.80	1.75	1.69	
27	2.20	2.13	2.06	1.97	1.93	1.88	1.84	1.79	1.73	1.67	
28	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77	1.71	1.65	
29	2.18	2.10	2.03	1.94	1.90	1.85	1.81	1.75	1.70	1.64	
30	2.16	2.09	2.01	1.93	1.89	1.84	1.79	1.74	1.68	1.62	
40	2.08	2.00	1.92	1.84	1.79	1.74	1.69	1.64	1.58	1.51	
60	1.99	1.92	1.84	1.76	1.71	1.66	1.61	1.56	1.50	1.43	
120	1.91	1.83	1.75	1.66	1.61	1.55	1.50	1.43	1.35	1.25	
∞	1.83	1.75	1.67	1.57	1.52	1.46	1.39	1.32	1.22	1.00	

Critical Values of the F-Distribution

$f_{\alpha}(v_1, v_2)$

v_2	v_1								
	1	2	3	4	5	6	7	8	9
1	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04
120	3.92	3.07	2.68	2.45	2.29	2.17	2.09	2.02	1.96
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88

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一、單選題 (每題 2 分 共 60 分)

- 一個小型的區域網路使用下列哪一項設備來連接最簡單且省錢？
(A) Router (B) Switch (C) Hub (D) Repeater
- 以下哪種安全機制，常用來防止全球資訊網瀏覽器資料傳送過程中被不當的擷取？
(A) SET (B) SSL (C) PKI (D) Firewall
- 下列哪一種技術是屬於瀏覽器端的技術？
(A) DHTML (B) ASP (C) PHP (D) JSP
- 若申請有五個固定 IP 的 ADSL 線路時，子網路罩應設為多少？
(A) 255.255.255.0 (B) 255.255.255.128
(C) 255.255.255.192 (D) 255.255.255.248
- C 語言之函數 fun1 之定義如下：

```
int fun1(int n)
{
    if(n == 0)
        return(2);
    else
        if(n == 1)
            return(1);
        else
            return(2 * fun1(n-1) + 3 * fun1(n-2));
}
```

試問 fun1(5) = ?

- (A) 87 (B) 143 (C) 181 (D) 217
- 在 C 語言之 int a, *b, **c, d[5], *e[5]; 宣告下，下列用法何者正確？
(A) *e[2] = a; (B) *b = 3; (C) a = **c; (D) b = d;
- 假設一二維陣列 A[10][5]，陣列元素大小為 4，其起始位置 febc，註標是從 0 開始，在 row major 情況下。試問下列哪一個陣列元素的位址是正確？
(A) A[2][4] = fef2 (B) A[5][2] = ff24 (C) A[7][3] = ff54 (D) A[9][1] = ff70
- 下列有關資料結構之敘述何者正確？
(A) 處理數學方程式時常用 Linked List 來儲存數學方程式的次方及係數
(B) 作業系統中排程常用 Stack 來達成
(C) 程式執行時函數呼叫常用 Queue 來完成
(D) 動態空間分配常用 Tree 來完成



9. 數學計算式 $A/B ** C * D + E$ (優先次序： $** > *, / > +, -$)，以下何者正確？
 (A) Prefix： $+ * / ** A B C D E$ (B) Prefix： $+ * / A B ** C D E$
 (C) Postfix： $A B C D E ** / * +$ (D) Postfix： $A B C ** / D * E +$
10. 下列有關 Binary Tree 之敘述何者不正確？
 (A) A binary tree is a finite set of nodes which is either empty or consists of a root and two disjoint binary trees
 (B) A full binary tree of depth k is a binary tree of depth k having $2^{k-1} - 1$ node
 (C) For any nonempty binary tree, T , if n_0 is the number of terminal nodes and n_2 is the number of nodes of degree 2, then $n_0 = n_2 + 1$
 (D) A binary tree with n nodes and of depth k is complete iff its nodes correspond to the nodes which are numbered one to n in the full binary trees of depth k
11. 目前主流資料庫的結構是下列哪種類型？
 (A) Hierarchical (B) Network (C) Relational (D) Object-Oriented
12. 下列何者不是作業系統主要的功能？
 (A) 程式管理 (B) CPU 管理 (C) 磁碟管理 (D) 記憶體管理
13. 下列的敘述何者不正確？
 (A) 目前硬碟的空間大多以 GB 為單位
 (B) Parity Check 可以更正資料的錯誤
 (C) 在電腦內中文以 2 個 byte 儲存
 (D) 目前的個人電腦是屬於 CISC 的架構
14. 下列的敘述何者不正確？
 (A) DVD-ROM 的容量比 CD-ROM 的容量大好幾倍
 (B) 檔案是由許多記錄所組成的
 (C) 微處理器可擴充 RAM 來加快其處理速度
 (D) 電腦中常用的進位有 2 進位及 16 進位
15. 下列有關資料庫的敘述何者不正確？
 (A) 使用資料庫比檔案較易保持資料的一致性
 (B) 資料儲存在資料庫比檔案好
 (C) SQL 可以存取資料庫中之資料
 (D) DBMS 支援 DDL 與 DML 的操作
16. 以下有關功能式程式設計 (functional programming) 的陳述，何者為真？
 (A) 只有功能式的程式語言才能撰寫功能式的程式。
 (B) 以 C 語言撰寫功能式的程式可以變動全域變數 (global variable) 的值。
 (C) 功能式程式可以使用 loop-control variable 來控制迴圈的結束。
 (D) 功能式程式主要是透過函數間 (function) 參數值的傳遞來完成運算。



17. 以下有關程式語言變數 (variables) 的陳述，何者為假？
- (A) Java 語言也可以讓程式設計師，獲得變數的地址。
 - (B) C 語言中變數的型態若使用錯誤，編譯器不一定會在 compile-time 產生錯誤信息。
 - (C) C 語言提供程式設計師獲得變數地址的功能。
 - (D) Perl 語言變數的型態在使用前不需要宣告。
18. 以下有關物件導向程式設計 (object-oriented programming) 的陳述，何者為真？
- (A) 物件導向的程式中不容許有同名的方法 (methods)。
 - (B) 只有物件導向程式語言可以有 operator overloading 的功能。
 - (C) 動態連結 (dynamic binding) 是一個與方法呼叫 (method call) 有關的觀念。
 - (D) 儲存物件的變數的型態必須事先宣告，而且在程式執行中不得更動。
19. 以下有關程式語言記憶體管理的觀念何者為真？
- (A) 提供自動記憶體管理機制的程式語言，不會出現誤用指標的錯誤。
 - (B) 支援自動化記憶體管理的程式語言必須要求程式設計師先宣告變數的型態。
 - (C) C 語言不提供程式設計師管理記憶體的機制。
 - (D) 程式執行時所用到的堆疊 (stack) 不被 garbage collector 所管理。
20. 以下有關程式語言的觀念何者不真？
- (A) 要求使用者宣告變數型態的程式語言，執行的效率較高。
 - (B) 要求使用者宣告變數型態的程式語言，比較節省記憶體。
 - (C) C 語言的編譯器，可以找到所有關於型態 (type) 誤用的錯誤。
 - (D) C 語言支援 static binding 的功能。
21. 以下有關網路程式設計的陳述，何者為真？
- (A) HTTP 是一個也可以儲存瀏覽器端狀態的協定。
 - (B) C++ 語言不能撰寫 CGI 的程式。
 - (C) CGI 程式的輸出必須符合 HTML 的語法規定。
 - (D) HTML 內嵌式程式語言是透過連接於 HTTP 伺服器內的解譯器執行。
22. 以下有關 Linux 系統或公開原始碼軟體的陳述，何者為真？
- (A) Perl 是一個亦可在 Win32 平台執行的開放原始碼程式語言。
 - (B) GPL 是 Linux 系統使用的一個程式圖書館。
 - (C) Linux 的開發人員需要固定的集會，以討論系統的問題與解決方法。
 - (D) gcc 是一個視窗介面工具。



23. 以下哪個功能的執行一定需要瀏覽器的配合？
- (A) Session
 - (B) Cookie
 - (C) Database access
 - (D) Generate HTML
24. 以下有關 Java abstract class 的觀念何者為真？
- (A) abstract class 不可以有方法 (method) 的定義。
 - (B) abstract class 不可以宣告物件變數 (instance variable)
 - (C) abstract class 不可以產生物件 (instances)
 - (D) abstract class 也可以是 final class.
25. 以下有關 Java class variable 的觀念何者不真？
- (A) class variable 是用 static 這個保留字來宣告的。
 - (B) 分配給物件的記憶體，也儲存著 class variable 的值。
 - (C) 一般的方法也可以存取 class variable 的值。
 - (D) 一個 public 的 class variable 可以說是一個 global variable。
26. 以下有關作業系統的觀念，何者不真？
- (A) LIFO 是一種適合 process scheduling 的資料結構。
 - (B) 虛擬記憶 (virtual memory) 需要磁碟機的空間才能實現。
 - (C) context switch 是支援分時 (time sharing) 的必要功能。
 - (D) Linux 與 NT 都支援分時與虛擬記憶的功能。
27. 以下有關組合語言的觀念何者不真？
- (A) 組合語言是計算機軟硬體間的主要介面。
 - (B) Java 編譯器最後也是產生組合語言的程式碼。
 - (C) 組合語言不直接支援函數 (functions) 的定義及呼叫。
 - (D) 組合語言有直接讀取微處理器中暫存器 (registers) 的功能。
28. 以下有關常規表示法 (regular expression) 的陳述，何者不真？
- (A) 程式語言中用來規定變數名稱的寫法規定是一種常規表示法。
 - (B) 程式語言中用來規定數字的寫法規定也是一種常規表示法。
 - (C) 一個常規表示法可以用狀態轉換圖表達 (state transition diagram)。
 - (D) 常規表示法規定了程式語言的邏輯運算式的寫法規則。



29. 以下有關抽象式資料型態 (abstract data type) 的陳述，何者不真？
- (A) 抽象式資料型態是一種建構資料結構的方法。
 - (B) 抽象式資料型態的使用者，可以透過公開的介面 (interface)，使用其資料結構。
 - (C) 抽象式資料型態建構其資料結構的方法可以改變，但是使用它的程式需要修改，否則無法正常運作。
 - (D) C 語言也可以撰寫抽象式資料型態。
30. 以下有關 C 語言的陳述，何者不真？
- (A) C 語言是一個支援傳值呼叫 (call-by-value) 的程式語言。
 - (B) C 語言也支援傳址呼叫 (call-by-reference)。
 - (C) C 函數 (functions) 的參數與區域變數的記憶體會自動的利用堆疊 (stack) 產生與消除。
 - (D) extern 的使用與 linker 無關。

二、問答題 (40 分)

1. 何謂 EC、B2B、B2C？試舉出目前應用 B2B、B2C 的企業或網站各 2 個。
(10 分)
2. 在系統開發過程中，首先需取得系統需求，然後做系統分析與系統設計的工作。試簡述二種較常用系統分析的方法。
(10 分)
3. HTML 內嵌式網路程式語言如 ASP 與 PHP 是目前開發網路程式的主流。試從程式語言與軟體開發的觀點簡要說明 HTML 內嵌式網路程式語言的缺點。
(5 分)
4. 試以 C、Java、Perl 中的任一種語言撰寫一個程式。這個程式有內建的姓名與密碼的資料結構。當使用者從 stdin 輸入一個姓名後，程式就把相對應的密碼印出，若沒有該姓名的資料則印出「找不到」，程式持續的可以讓使用者查詢密碼的資料，直到使用者輸入 999 為止。請注意程式語法與邏輯等各方面的細節，錯誤愈少，愈接近能執行的程式，分數愈高。請將以下的資料存在資料結構中，不可以只用條件判斷式將資料內建於程式碼內。
(15 分)

Name:	Password:
Mary	Dog_and_cat
Peter	Simon
Paul	Rome
Tim	Borther



Part I. Microeconomics (each question 2 points): choose the best answer. (答錯不例扣)

1. Suppose that two book stores are located at $a=1/4$ and $b=5/8$. What is the point of market segmentation according to Harold Hotelling's model?
 - (A) $1/3$.
 - (B) $7/16$.
 - (C) $1/2$.
 - (D) Cannot be determined with the information given.
2. Non-satiation implies that consumption bundles:
 - (A) Which contain fewer of all goods are preferred.
 - (B) Which contain more of one good and less of another are preferred.
 - (C) Which contain more of all goods are preferred.
 - (D) Which are nearer the origin are preferred.
3. Which of the following assumptions is not generally applied to an indifference curve?
 - (A) Convex.
 - (B) Diminishing MRS.
 - (C) Smooth.
 - (D) Transitive.
4. Beth consumes two goods, x_1 and x_2 , and her income is \$120. The price of x_1 is \$10, and the price of x_2 is \$5. If her utility function is $U(x_1, x_2) = x_1 + x_2$, her utility maximizing bundle is:
 - (A) (7, 10).
 - (B) (12, 0)
 - (C) (0, 24)
 - (D) (8, 8)
5. If two linear demand functions intersect the quantity axis at the same point, then:
 - (A) When quantities are equal, so are the price elasticities.
 - (B) When prices are equal, so are the elasticities.
 - (C) At the point of intersection the two elasticities are equal to one.
 - (D) None of the above.
6. Tom currently has 100 units of x_1 and 50 units of x_2 , and Jan has 50 units of x_1 and 100 units of x_2 . Tom's marginal rate of substitution is 10, and Jan's is 1.
 - (A) Pareto-improving trades involve Tom giving up x_1 for x_2 .
 - (B) Pareto-improving trades between Jan and Tom do not exist.
 - (C) Pareto-improving trades involve Jan giving up x_2 for x_1 .
 - (D) None of the above.



7. The Paasche and the Laspeyres indexes:
 - (A) Always agree with each other.
 - (B) Give the same numerical value
 - (C) Give the same qualitative values.
 - (D) May contradict each other.
8. If a good is neither normal nor inferior, then:
 - (A) The income effect is larger than the substitution effect.
 - (B) The income effect is smaller than the substitution effect.
 - (C) There are no income effects.
 - (D) There are no substitution effects.
9. According to the separation theorem, individuals choose consumption expenditures by choosing the one that maximizes utility while making the present value of income:
 - (A) Not smaller than the present value of consumption expenditures.
 - (B) Equal to the present value of consumption expenditures.
 - (C) Independent of the present value of consumption expenditures.
 - (D) Not larger than the present value of consumption expenditures.
10. The life cycle model hypothesizes that:
 - (A) Older people spend more than they earn.
 - (B) Younger people earn more than they spend.
 - (C) Younger people spend more than they earn.
 - (D) Older people are less risk averse.
11. Suppose that a firm uses a technology for which the MP of a variable factor is initially rising. Then:
 - (A) Total And AP are maximized when MP is zero.
 - (B) MP is maximized before AP.
 - (C) MP is maximized before AP is falling.
 - (D) The firm will never reach diminishing marginal productivity.
12. Variable cost may be defined as:
 - (A) The least expenditure on variable inputs to produce a level of output.
 - (B) The vertical distance between the APC and SRAC at level of output.
 - (C) The change in TC as more of the variable factor is employed.
 - (D) None of the above.
13. The demand for inputs is conditional on the :
 - (A) Supply of inputs.
 - (B) Marginal rate of technical substitution.
 - (C) Level of output.
 - (D) Consumer's choice problem.



14. A competitive firm's short run supply curve is its:
- SAC curve to the right of its SMC curve.
 - Owner's preference function.
 - SMC curve above its SAVC curve.
 - SMC curve above its SAC curve.
15. Import tariffs have the effect of:
- Reducing producer surplus.
 - Increasing consumer surplus.
 - Increasing producer surplus.
 - Lowering the market price in the domestic economy.
16. If everyone thought that the world will end tomorrow:
- The interest rate would fall to zero.
 - The interest rate would rise to infinity.
 - No one would want to borrow anything.
 - The effect would be the same as if only 10% of people thought the world will end tomorrow.
17. The profit-maximizing monopolist that faces a horizontal TC curve will:
- Shut down and move to his best alternative employment.
 - Charge a price equal to MC and satisfy total market demand.
 - Produce that level of output at which MR is equal to zero.
 - None of the above.
18. Donna's firm uses one input, z , and she sells her output at \$10 per unit. The marginal product of z is $10-z$ and the price of z is \$20 per unit. The profit maximizing quantity of z is:
- 5
 - 10
 - 5.5
 - 8
19. Which of the following assumptions does not apply to Edgeworth Box discussions of general equilibrium:
- All Edgeworth Box allocations are Pareto optimal.
 - Both goods are essential for all consumers.
 - Economic well being is determined only by the quantities consumed.
 - Indifference curves are smooth and convex to the appropriate origin.



20. A profit maximizing monopsonist chooses aggregate quantity of input so that:
- (A) Price equals marginal factor cost.
 - (B) Marginal revenue product equals aggregate marginal factor cost.
 - (C) Marginal factor cost equals aggregate input quantity.
 - (D) None of the above.
21. The level of output per firm under Nash and Cournot equilibriums are:
- (A) Always the same.
 - (B) Never the same.
 - (C) Often the same.
 - (D) Seldom the same.
22. The equilibrium price in the Chamberlin model of monopolistic competition is:
- (A) Both individually and collectively irrational.
 - (B) Collectively rational but individually irrational.
 - (C) Both collectively and individually rational.
 - (D) Individually rational but collectively irrational.
23. The expected utility hypothesis requires information about all of the following except:
- (A) Outcomes.
 - (B) Preferences.
 - (C) Probabilities.
 - (D) Prospects.
24. Transactions costs are costs that violate:
- (A) The rules of the game.
 - (B) The Coase theorem.
 - (C) The rules of market allocation.
 - (D) Economic property rights.
25. The term adverse selection refers to a situation where:
- (A) Most people are poor insurance risks.
 - (B) People who buy insurance need it.
 - (C) Most people don't need insurance.
 - (D) People are over-insured.



Part II. Macroeconomics (each question 2 points): choose the best answer. (答錯不倒扣)

1. The central macroeconomic concept that is most clearly related to changes in the well-being of the average member of the economy is the
 - A. Inflation rate.
 - B. Interest rate.
 - C. Foreign trade deficit.
 - D. Productivity growth rate.
2. A foreign trade deficit is financed by a combination of
 - A. Selling securities to foreigners and buying foreign assets.
 - B. Selling securities and assets to foreigners.
 - C. Buying foreign securities and selling assets to foreigners.
 - D. Buying foreign securities and assets.
3. In the simple circular flow model containing just households and business firms, all income is received by households in exchange for
 - A. Consumer expenditures.
 - B. Wages.
 - C. Labor services.
 - D. Product.
4. Which of the following is not a "flow" variable?
 - A. Government debt.
 - B. Consumption expenditure.
 - C. Labor services.
 - D. Income.
5. Which of the following is included in the GDP?
 - A. The current services flowing from the housing stock.
 - B. The estimated value of drugs sold illegally.
 - C. The estimated value of leisure time.
 - D. Transfer payments such as Social Security and veterans' benefits.
6. A change in real GDP sums up changes in
 - A. Prices alone.
 - B. Physical production alone.
 - C. Physical production minus changes in price.
 - D. Physical production and prices.
7. Fluctuations in total output are the reverse image of fluctuations in
 - A. The inflation rate.
 - B. The unemployment rate.
 - C. Gross domestic product.



- D. The GDP deflator.
8. Suppose that equilibrium income is 3200 and the multiplier is 2.38. Equilibrium income would rise to 3400 if planned investment
- Rises by 84.03.
 - Rise by 476.
 - Rises by 105.
 - Rises by 256.
9. At every point on the IS curve, the level of income on the horizontal axis equals
- Planned autonomous spending.
 - Planned autonomous spending times the multiplier.
 - Planned autonomous spending divided by the multiplies.
 - Planned expenditures times the multiplier.
10. In the IS-LM model, equilibrium income can be affected by
- Fiscal policy alone.
 - Monetary policy alone.
 - Both fiscal and monetary policy.
 - Neither monetary nor fiscal policy.
11. In deriving LM curves, holding the real money supply constant while raising real GDP cause us to
- Trace up along an LM curve.
 - Trace down along an LM curve.
 - Shift the LM curve to the right.
 - Shift the LM curve to the left.
12. A vertical IS curve comes from the assumption that changes in the interest rate do not affect
- The money demand.
 - The money supply.
 - Autonomous planned spending.
 - The LM curve.
13. In the IS-LM model, the fiscal multiplier effect can be increased by
- Larger increases in government expenditure.
 - Expansions of the money supply.
 - Contractions of the money supply.
 - Raising the income tax rate.
14. Suppose we have an economy for which $G = 300$, $T = 240$, $S = 80$, $I = 45$, and imports = 40. Exports must be
- 25.



- B. 40.
C. 15.
D. 65.
15. Actual output exceeds the natural output when
- The actual budget deficit is above the structural deficit.
 - The actual budget deficit is below the structural deficit.
 - The structural deficit is positive.
 - The structural deficit is negative.
16. The Bretton Woods system broke down due to
- The British devaluation of the pound in 1967.
 - Consistent U.S. trade surpluses draining dollar reserves from other nations.
 - Large U.S. trade deficits forcing foreign central banks to buy too many dollars.
 - Nations disallowing shipments of gold at the outbreak of World War II.
17. In moving from a small open to a large open economy model, one policy has its effectiveness in changing equilibrium income enhanced:
- Monetary policy under fixed exchange rates.
 - Fiscal policy under fixed exchange rates.
 - Monetary policy under flexible exchange rates.
 - Fiscal policy under flexible exchange rates.
18. A rise in the price level causes
- The LM curve to shift downward.
 - The LM curve to shift upward.
 - Movement up along an LM curve.
 - Movement down along an LM curve.
19. The "Pigou effect" is the stimulus to aggregate demand when a lower price level causes
- A lower interest rate to increase fixed investment.
 - A lower interest rate to increase inventory investment.
 - A lower interest rate to increase the demand for consumer durables.
 - Holdings of money to increase in purchasing power, thus raising consumption demand.
20. The "New Keynesian" macroeconomics is centered on
- The assumption of continuous market-clearing.
 - The importance of technological shocks.
 - The imperfectness of the information held by economic decision-makers.
 - The rational reasons for slow price and wage adjustment.



21. In the fooling model, real wages
- A. Are countercyclical.
 - B. Are procyclical.
 - C. Are constant.
 - D. Show no clear cyclical pattern.
22. The New Classical assumption of how quickly markets clear is actually most appropriate in the analysis of
- A. The labor market.
 - B. The aggregate good market.
 - C. Financial markets.
 - D. The market for consumer durables.
23. If nominal demand falls by 4 percent, real output remains unaffected
- A. If every firm raises its price by 4 percent.
 - B. If every firm holds its price constant.
 - C. If every firm lowers its price by 4 percent.
 - D. Under no circumstances: it must fall.
24. When the expected inflation rate is 5 percent, we know to draw the short-run Phillips curve through the
- A. Horizontal axis at $Y = 105$.
 - B. Horizontal axis at $P = 1.05$.
 - C. Long-run Phillips curve at $P = 1.05$.
 - D. Long-run Phillips curve at $P = 5$.
25. Over a year, the money supply in a nation grew by 6 percent, while velocity fell by 1 percent and real GDP rose by 2 percent. This results in an inflation over the year of
- A. 9 percent.
 - B. 7 percent.
 - C. 5 percent.
 - D. 3 percent.