注意：請按照題號及子題號順序作答；不按題號順序作答不以計分。

I. 是非題 (True (T) or False (F), 共十五分；答對一題得五分、答錯一題扣三分。)

(1) Each optimal solution of one LP is a basic feasible solution of this LP.

(2) While solving a maximization integer programming problem (in branch and bound method), we obtain a subproblem with integer optimal solution x' with bound $Z' \geq Z^*$ (Z^* is the function value of the current candidate solution). In such case, x' can be the new candidate solution.

(3) Dijkstra's method is designed only for shortest path problems with positive arcs.

II. 問答題(共八十五分) (除特別聲明，計算過程請勿附上)

II.1 (十分)

Given the following Linear Programming problem:

$$\min \quad 2x_{11} + 4x_{12} + 9x_{13} + 8x_{21} + 2x_{22} + 6x_{23} + 9x_{31} + 4x_{32} + 16x_{33}$$
$$\text{s.t.} \quad x_{11} + x_{12} + x_{13} = 1, \quad x_{21} + x_{22} + x_{23} = 1, \quad x_{31} + x_{32} + x_{33} = 1$$
$$x_{11} + x_{21} + x_{31} = 1, \quad x_{12} + x_{22} + x_{32} = 1, \quad x_{13} + x_{23} + x_{33} = 1$$
$$x_{11}, x_{12}, x_{13}, x_{21}, x_{22}, x_{23}, x_{31}, x_{32}, x_{33} \geq 0$$

Please use "Northwest Corner" Method to find an initial basic feasible solution for this problem.

(A). What are your basic variables and their corresponding values? (5分)

(B). What is the entering variable and its corresponding leaving variables? (5分)

II.2 (五分)

Given the following Linear Programming problem:

$$\max \quad 60x_1 + 30x_2 + 20x_3$$
$$\text{s.t.} \quad 8x_1 + 6x_2 + x_3 \leq 48$$
$$4x_1 + 2x_2 + 1.5x_3 \leq 20.$$
$$2x_1 + 1.5x_2 + 0.5x_3 \leq 8$$
$$x_1, x_2, x_3 \geq 0$$

and its optimal solution $(x_1, x_2, x_3) = (2, 0, 8)$, what can be said (must be zero, must be nonzero or undetermined) about the optimal values of the dual variable (y_1, y_2, y_3) and dual excess variables (r_1, r_2, r_3) without considering its dual problem?

II.3 （二十分）

Given the following Linear Programming problem:

$$\max\ x_1 - 5x_2 + 3x_3 + 9x_4 + x_5 - x_6$$

$$\text{s.t.}\quad x_1 - 2x_2 + x_3 + 2x_4 + 3x_6 = 6$$

$$x_1 + x_2 - x_4 + x_5 + 2x_6 = 3\quad,$$

$$x_1 - 2x_4 + 3x_6 = 3$$

$$x_1,\ x_2,\ x_3, x_4, x_5, x_6 \geq 0$$

and one intermediate step of the simplex tableau for above LP.

x_1	x_2	x_3	x_4	x_5	x_6	RHS
0	(a)	0	(b)	0	(c)	(d)
0	−2	1	4	0	0	3
0	1	0	1	1	−1	(e)
1	0	0	−2	0	3	3

(A). What are the values of (a) to (e) in above tableau? (10分)

(B). Is the current solution degenerate? Why? (3分)

(C). Is the current solution optimal? Why? (4分)

(D). Are there multiple optimal solutions? Why? (3分)

II.4 （三十分）

Peter has $3 dollars in his pocket and goes to gamble at a casino. Each time he bets for $1, if he wins, with probability p, he gains $1, otherwise he loses $1. Peter's policy is to end the gambling game when the amount of money in his pocket reaches $5 of $1. Let us propose three processes to describe Peter's gambling: $\{X_n, n = 0,1,2,...\}$, $\{Y_n, n = 0,1,2,...\}$ and $\{Z_n, n = 0,1,2,...\}$, where $X_n = 1$ if Peter wins at the nth gambling and $X_n = 0$, otherwise; Y_n denotes the accumulated number of winning that peter made up till game n (including game n) and Z_n is the amount of money that Peter has in his pocket after game n. Please give a detailed explanations for your answers of the following questions, points are given only if detailed explanations are provided.

(A). Is $\{X_n, n = 0,1,2,...\}$ a Markov chain? (10分)

(B). Is $\{Y_n, n = 0,1,2,...\}$ a Markov chain? (10分)

(C). Is $\{Z_n, n = 0,1,2,...\}$ a Markov chain? (10分)

II.5 （二十分）

Referring to the last problem (II.4), if $p = 0.6$, find the probability that when Peter quits the games, he has $5 in his pocket. （本題為計算題，請附上詳細計算過程）

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In this test, there are 20 multiple choice questions with 5 points for each question. Please select the correct answer for each question.

1. The ages of people in a class (to the nearest year) are as follows:

Age	18	19	20	21	22	23	24	25	32
Number of students	14	120	200	200	90	30	10	2	1

What is true about the median age?

(A) It must be 20.   (B) It could be any number between 19 and 21.
(C) It must be 21.   (D) It must be over 21.
(E) None of the above answer is correct.

2. You select an employee at random from all those in a large company. An employee can be either male or female, and can be under 30 years old, between 30 and 45 years old, or over 45 years old. The table below gives the probability of each of the six possible age and gender combinations for a randomly selected employee.

|	Under 30	30 – 45	Over 45	Under 30	30 – 45	Over 45
Age-gender Combination	Male	Male	Male	Female	Female	Female
Probability	.3	.3	?	.1	.1	.1

The probability that you select neither a male nor a female under 30 years of age is
(A) .1   (B) .3   (C) .4   (D) .5   (E) .6

3. A survey asks a random sample of 1500 adults in Ohio if they support an increase in the state sales tax from 5% to 6%, with the additional revenue going to education. Let X denotes the number in the sample that say they support the increase. Support that 40% of all adults in Ohio support the increase. The standard deviation of X is
(A) 18.97   (B) 26.69   (C) 75   (D) 360   (E) 600

4. A fair coin (one for which both the probability of heads and the probability of tails are 0.5) is tossed six times. The probability that less than 1/3 of the tosses are heads is .
(A) 0.3333   (B) 0.1667   (C) 0.1094   (D) 0.0938   (E) 0.0043

The following information is used in problems 5 – 6.

The probability density of a random variable X is given in the figure below.
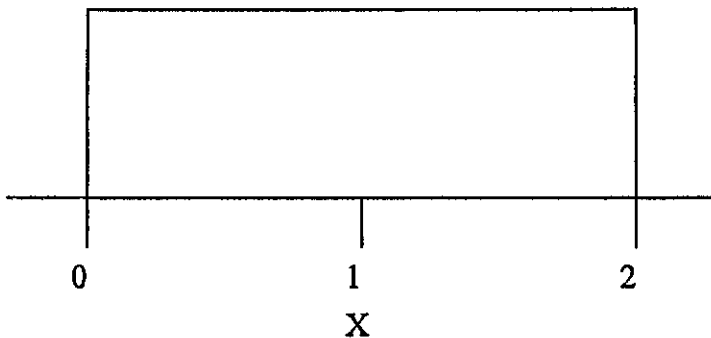
5. From this density, the probability that X is between 0.5 and 1.5 is
   (A) 1/4 (B) 1/3 (C) 1/2 (D) 3/4 (E) 1

6. The probability that X = 1.5 is
   (A) 0 (B) 1/4 (C) 1/3 (D) 1/2 (E) 1

7. A multiple choice exam has 100 questions, each with five possible answers. If a student is just guessing that all the answers, the probability that he or she gets at least 30 correct is
   (A) 0.2000 (B) 0.1020 (C) 0.0228 (D) 0.0062 (E) 0.3000

8. During the evening hours of 7 PM until 9 PM, the number of calls received at a suicide hotline can be modeled as a Poisson distribution with a mean of 3.5 calls per 15 minutes. The probability of zero calls in a 15-minute period is 0.0302. The probability of getting zero calls between 7:30 PM and 8:00 PM is
   (A) 0.0009 (B) 0.0151 (C) 0.0302 (D) 0.0604
   (E) None of the above answer is correct.

Use the following to answer questions 9-10.
A particular electronic component is produced at two plants for an electronics manufacturer.
Plant A produces 60% of the components used and the remainder are produced by plant B.
The proportion of defective components produced at plant A is 1% and the proportion of defective components produced at plant B is 2%.

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9. If a component received by the manufacturer is defective, the probability that it was produced at plant A is
   (A) 0.14286   (B) 0.28571   (C) 0.42857   (D) 0.57142   (E) 0.71429

10. If a component received by the manufacturer is not defective, the probability that it was produced at plant A is
   (A) 0.398   (B) 0.602   (C) 0.622   (D) 0.684   (E) 0.713

11. According to Barron's 1998 Primary Reader Survey, the average annual number of investment transactions for a subscriber is 24. Suppose the number of transactions in a year follows a Poisson probability distribution. What is the probability of no transactions during the month of January for a particular subscriber?
   (A) 0.0333   (B) 0.0417   (C) .0500   (D) 0.0821   (E) 0.1353

12. A police officer wants to estimate the true proportion of all drivers who exceed the speed limit on a certain stretch of road where accidents frequently happen. How large should the sample to be so that, with 95 percent confidence, the sample proportion will not differ from the true proportion by more than .027?
   (A) 673   (B) 36   (C) 1318   (D) 899   (E) 30

13. A major department store chain is interested in estimating the average amount its credit card customers spent on their first visit to chain's new store in the mall. Fifteen credit card amounts were randomly sampled and analyzed with following results: $\bar{x} = \$50.50$ and $s^2 = 400$. Construct a 95% confidence interval for the average amount its credit card customers spent on their first visit to the chain's new store in the mall.
   (A) $\$50.50 \pm \$26.67$
   (B) $\$50.50 \pm \$11.08$
   (C) $\$50.50 \pm \$10.12$
   (D) $\$50.50 \pm \$9.09$
   (E) $\$50.50 \pm \$5.16$

Use the following problem to answer questions 14-16.
In 1990, the average duration of long-distance telephone calls originating in one town was 8.7 minutes. A long-distance telephone company wants to perform a test to determine whether the average duration of long-distance phone call has changed from year of 1990. A random sample of size 62 was selected and sample mean is 10.4 minutes. Assume that $\sigma = 5.9$, and the significance level is .05.

14. Which alternative hypothesis is being tested?

(A) H_a: $\mu > 8.7$ (B) H_a: $P > 0.05$ (C) H_a: $\mu \neq 0$

(D) H_a: $P \neq 0.05$ (E) H_a: $\mu \neq 8.7$

15. Express the decision criterion for the hypothesis test in terms of $\bar{x}$.

(A) Reject H_0 if $\bar{x} < 7.23$ (B) Reject H_0 if $7.23 < \bar{x} < 10.17$

(C) Reject H_0 if $\bar{x} < -1.96$ (D) Reject H_0 if $\bar{x} < 7.23$ or $\bar{x} > 10.17$

(E) Reject H_0 if $\bar{x} > 1.96$.

16. The **p-value** of the test is
(A) 0.0119   (B) 0.4481   (C) 0.05   (D) 0.0232   (E) 0.5228

Use the following problem to answer questions 17-18.
In placing a weekly order, a concessionaire who provides services at a baseball stadium must know what size crowd is expected during the coming week in order to know how much food, etc., to order. Since advance ticket sales give an indication of expected attendance, food needs might be predicted on the basis of the advance sales. A random sample of size 20 was selected and the following least squares model was obtained.
$$\hat{y} = 2.084 + 0.67x, \text{ where } R^2 = .55$$

17. Which of the following values represents the test statistic for determining if the model is a useful to predict the amount of food needed?
(A) 22   (B) 4.41   (C) 2.084   (D) 0.67   (E) 0.55

18. Which of following statement about this regression model is correct?
(A) The model explains about 55% of the variation in mean advance ticket sales sampled.
(B) The dependent variable (response) is the advance ticket sales.
(C) If one more ticket is sold, the average foods were estimated to increase 0.67 units.
(D) The correlation between foods need and ticket sales about 55%.
(E) The food needed is about 2.084 units.

Use the following problem to answer questions 19-20.

An educational psychologist claims that the order of questions on an exam affects the student's score on the exam. She believes that students will score better on an exam if questions are ordered from easiest to hardest. To test the claim, she randomly selects two groups of 10 students each to take exam A (questions are ordered from easiest to hardest) and exam B (random order).

Exam A	Exam B
$\overline{X}_1 = 87$	$\overline{X}_2 = 83$
$S_1^2 = 12$	$S_2^2 = 10$

19. Find the test statistic in order to test whether the data support the psychologist claim. Use $\alpha = .05$.

   (A) 4   (B) 2.70   (C) 11   (D) 2.2   (E) 1.48

20. Give the rejection region appropriate when testing $\alpha = .05$ to determine whether the order of questions on an exam affects the student's score on the exam.

   (A) Reject H_0 if $z > 1.645$

   (B) Reject H_0 if $F > 1.79$

   (C) Reject H_0 if $t > 1.734$

   (D) Reject H_0 if $z > 1.96$ or $z < -1.96$

   (E) Reject H_0 if $F > 2.12$

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TABLE II
Areas under the
standard normal curve
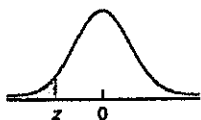
0.09	0.08	0.07	0.06	0.05	0.04	0.03	0.02	0.01	0.00	z
									0.0000†	−3.9
0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	−3.8
0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	−3.7
0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	−3.6
0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	−3.5
0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	−3.4
0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005	−3.3
0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007	−3.2
0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010	−3.1
0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013	−3.0
0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019	−2.9
0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026	−2.8
0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035	−2.7
0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047	−2.6
0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062	−2.5
0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082	−2.4
0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107	−2.3
0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139	−2.2
0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179	−2.1
0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228	−2.0
0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287	−1.9
0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359	−1.8
0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446	−1.7
0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548	−1.6
0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668	−1.5
0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808	−1.4
0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968	−1.3
0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151	−1.2
0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357	−1.1
0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587	−1.0
0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841	−0.9
0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119	−0.8
0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420	−0.7
0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2709	0.2743	−0.6
0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2981	0.3015	0.3050	0.3085	−0.5
0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446	−0.4
0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821	−0.3
0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207	−0.2
0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602	−0.1
0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4880	0.4920	0.4960	0.5000	−0.0

Second decimal place in z

† For z ≤ −3.90, the areas are 0.0000 to four decimal places.

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TABLE IV
Values of t_α
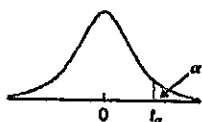
df	$t_{0.10}$	$t_{0.05}$	$t_{0.025}$	$t_{0.01}$	$t_{0.005}$	df
1	3.078	6.314	12.706	31.821	63.657	1
2	1.886	2.920	4.303	6.965	9.925	2
3	1.638	2.353	3.182	4.541	5.841	3
4	1.533	2.132	2.776	3.747	4.604	4
5	1.476	2.015	2.571	3.365	4.032	5
6	1.440	1.943	2.447	3.143	3.707	6
7	1.415	1.895	2.365	2.998	3.499	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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F distribution critical value landmarks

Table entries are critical values for F^* with probably p in right tail of the distribution.

Figure of F distribution (like in Moore, 2004, p. 656) here.

	p	Degrees of freedom in numerator (df1)
		1	2	3	4	5	6	7	8	12	24	1000
1	0.100	39.86	49.50	53.59	55.83	57.24	58.20	58.91	59.44	60.71	62.00	63.30
	0.050	161.4	199.5	215.7	224.6	230.2	234.0	236.8	238.9	243.9	249.1	254.2
	0.025	647.8	799.5	864.2	899.6	921.8	937.1	948.2	956.6	976.7	997.3	1017.8
	0.010	4052	4999	5404	5624	5764	5859	5928	5981	6107	6234	6363
	0.001	405312	499725	540257	562668	576496	586033	593185	597954	610352	623703	636101
2	0.100	8.53	9.00	9.16	9.24	9.29	9.33	9.35	9.37	9.41	9.45	9.49
	0.050	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.41	19.45	19.49
	0.025	38.51	39.00	39.17	39.25	39.30	39.33	39.35	39.37	39.41	39.45	39.49
	0.010	98.50	99.00	99.16	99.25	99.30	99.33	99.36	99.37	99.42	99.46	99.50
	0.001	998.38	998.84	999.31	999.31	999.31	999.31	999.31	999.31	999.31	999.31	999.31
3	0.100	5.54	5.46	5.39	5.34	5.31	5.28	5.27	5.25	5.22	5.18	5.13
	0.050	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.74	8.64	8.53
	0.025	17.44	16.04	15.44	15.10	14.88	14.73	14.62	14.54	14.34	14.12	13.91
	0.010	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.05	26.60	26.14
	0.001	167.06	148.49	141.10	137.08	134.58	132.83	131.61	130.62	128.32	125.93	123.52
4	0.100	4.54	4.32	4.19	4.11	4.05	4.01	3.98	3.95	3.90	3.83	3.76
	0.050	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	5.91	5.77	5.63
	0.025	12.22	10.65	9.98	9.60	9.36	9.20	9.07	8.98	8.75	8.51	8.26
	0.010	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.37	13.93	13.47
	0.001	74.13	61.25	56.17	53.43	51.72	50.52	49.65	49.00	47.41	45.77	44.09
5	0.100	4.06	3.78	3.62	3.52	3.45	3.40	3.37	3.34	3.27	3.19	3.11
	0.050	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.68	4.53	4.37
	0.025	10.01	8.43	7.76	7.39	7.15	6.98	6.85	6.76	6.52	6.28	6.02
	0.010	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	9.89	9.47	9.03
	0.001	47.18	37.12	33.20	31.08	29.75	28.83	28.17	27.65	26.42	25.13	23.82
6	0.100	3.78	3.46	3.29	3.18	3.11	3.05	3.01	2.98	2.90	2.82	2.72
	0.050	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.00	3.84	3.67
	0.025	8.81	7.26	6.60	6.23	5.99	5.82	5.70	5.60	5.37	5.12	4.86
	0.010	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.72	7.31	6.89
	0.001	35.51	27.00	23.71	21.92	20.80	20.03	19.46	19.03	17.99	16.90	15.77
7	0.100	3.59	3.26	3.07	2.96	2.88	2.83	2.78	2.75	2.67	2.58	2.47
	0.050	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.57	3.41	3.23
	0.025	8.07	6.54	5.89	5.52	5.29	5.12	4.99	4.90	4.67	4.41	4.15
	0.010	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.47	6.07	5.66
	0.001	29.25	21.69	18.77	17.20	16.21	15.52	15.02	14.63	13.71	12.73	11.72
8	0.100	3.46	3.11	2.92	2.81	2.73	2.67	2.62	2.59	2.50	2.40	2.30
	0.050	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.28	3.12	2.93
	0.025	7.57	6.06	5.42	5.05	4.82	4.65	4.53	4.43	4.20	3.95	3.68
	0.010	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.67	5.28	4.87
	0.001	25.41	18.49	15.83	14.39	13.48	12.86	12.40	12.05	11.19	10.30	9.36
9	0.100	3.36	3.01	2.81	2.69	2.61	2.55	2.51	2.47	2.38	2.28	2.16
	0.050	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.07	2.90	2.71
	0.025	7.21	5.71	5.08	4.72	4.48	4.32	4.20	4.10	3.87	3.61	3.34
	0.010	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.11	4.73	4.32
	0.001	22.86	16.39	13.90	12.56	11.71	11.13	10.70	10.37	9.57	8.72	7.84

Critical values computed with Excel 9.0

Degrees of freedom in denominator (df2)

國立雲林科技大學
97 學年度碩士班入學招生考試試題

系所：工管所、資管系
科目：統計學

	p	Degrees of freedom in numerator (df1)										
		1	2	3	4	5	6	7	8	12	24	1000
10	0.100	3.29	2.92	2.73	2.61	2.52	2.46	2.41	2.38	2.28	2.18	2.06
	0.050	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	2.91	2.74	2.54
	0.025	6.94	5.46	4.83	4.47	4.24	4.07	3.95	3.85	3.62	3.37	3.09
	0.010	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.71	4.33	3.92
	0.001	21.04	14.90	12.55	11.28	10.48	9.93	9.52	9.20	8.45	7.64	6.78
12	0.100	3.18	2.81	2.61	2.48	2.39	2.33	2.28	2.24	2.15	2.04	1.91
	0.050	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.69	2.51	2.30
	0.025	6.55	5.10	4.47	4.12	3.89	3.73	3.61	3.51	3.28	3.02	2.73
	0.010	9.33	6.93	5.95	5.41	5.06	4.82	4.64	4.50	4.16	3.78	3.37
	0.001	18.64	12.97	10.80	9.63	8.89	8.38	8.00	7.71	7.00	6.25	5.44
14	0.100	3.10	2.73	2.52	2.39	2.31	2.24	2.19	2.15	2.05	1.94	1.80
	0.050	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.53	2.35	2.14
	0.025	6.30	4.86	4.24	3.89	3.66	3.50	3.38	3.29	3.05	2.79	2.50
	0.010	8.86	6.51	5.56	5.04	4.69	4.46	4.28	4.14	3.80	3.43	3.02
	0.001	17.14	11.78	9.73	8.62	7.92	7.44	7.08	6.80	6.13	5.41	4.62
16	0.100	3.05	2.67	2.46	2.33	2.24	2.18	2.13	2.09	1.99	1.87	1.72
	0.050	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.42	2.24	2.02
	0.025	6.12	4.69	4.08	3.73	3.50	3.34	3.22	3.12	2.89	2.63	2.32
	0.010	8.53	6.23	5.29	4.77	4.44	4.20	4.03	3.89	3.55	3.18	2.76
	0.001	16.12	10.97	9.01	7.94	7.27	6.80	6.46	6.20	5.55	4.85	4.08
18	0.100	3.01	2.62	2.42	2.29	2.20	2.13	2.08	2.04	1.93	1.81	1.66
	0.050	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.34	2.15	1.92
	0.025	5.98	4.56	3.95	3.61	3.38	3.22	3.10	3.01	2.77	2.50	2.20
	0.010	8.29	6.01	5.09	4.58	4.25	4.01	3.84	3.71	3.37	3.00	2.58
	0.001	15.38	10.39	8.49	7.46	6.81	6.35	6.02	5.76	5.13	4.45	3.69
20	0.100	2.97	2.59	2.38	2.25	2.16	2.09	2.04	2.00	1.89	1.77	1.61
	0.050	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.28	2.08	1.85
	0.025	5.87	4.46	3.86	3.51	3.29	3.13	3.01	2.91	2.68	2.41	2.09
	0.010	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.23	2.86	2.43
	0.001	14.82	9.95	8.10	7.10	6.46	6.02	5.69	5.44	4.82	4.15	3.40
30	0.100	2.88	2.49	2.28	2.14	2.05	1.98	1.93	1.88	1.77	1.64	1.46
	0.050	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.09	1.89	1.63
	0.025	5.57	4.18	3.59	3.25	3.03	2.87	2.75	2.65	2.41	2.14	1.80
	0.010	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	2.84	2.47	2.02
	0.001	13.29	8.77	7.05	6.12	5.53	5.12	4.82	4.58	4.00	3.36	2.61
50	0.100	2.81	2.41	2.20	2.06	1.97	1.90	1.84	1.80	1.68	1.54	1.33
	0.050	4.03	3.18	2.79	2.56	2.40	2.29	2.20	2.13	1.95	1.74	1.45
	0.025	5.34	3.97	3.39	3.05	2.83	2.67	2.55	2.46	2.22	1.93	1.56
	0.010	7.17	5.06	4.20	3.72	3.41	3.19	3.02	2.89	2.56	2.18	1.70
	0.001	12.22	7.96	6.34	5.46	4.90	4.51	4.22	4.00	3.44	2.82	2.05
100	0.100	2.76	2.36	2.14	2.00	1.91	1.83	1.78	1.73	1.61	1.46	1.22
	0.050	3.94	3.09	2.70	2.46	2.31	2.19	2.10	2.03	1.85	1.63	1.30
	0.025	5.18	3.83	3.25	2.92	2.70	2.54	2.42	2.32	2.08	1.78	1.36
	0.010	6.90	4.82	3.98	3.51	3.21	2.99	2.82	2.69	2.37	1.98	1.45
	0.001	11.50	7.41	5.86	5.02	4.48	4.11	3.83	3.61	3.07	2.46	1.64
1000	0.100	2.71	2.31	2.09	1.95	1.85	1.78	1.72	1.68	1.55	1.39	1.08
	0.050	3.85	3.00	2.61	2.38	2.22	2.11	2.02	1.95	1.76	1.53	1.11
	0.025	5.04	3.70	3.13	2.80	2.58	2.42	2.30	2.20	1.96	1.65	1.13
	0.010	6.66	4.63	3.80	3.34	3.04	2.82	2.66	2.53	2.20	1.81	1.16
	0.001	10.89	6.96	5.46	4.65	4.14	3.78	3.51	3.30	2.77	2.16	1.22

Degrees of freedom in denominator (df2)

Use StaTable, WinPepi > Whatis, or other reliable software to determine specific p values

國立雲林科技大學
97 學年度碩士班入學招生考試試題

系所：工管所、運籌所
科目：微積分

注意：請按照題號及子題號順序作答；不按題號順序作答不以計分。
　　　第一題到第八題每題 5 分；第九題到第十八題每題 6 分。

1. Consider the function $y = x^4 - 2x^3$ for x between -1 and 3. Which one of the following statements is true?
   (a) There is a global maximum at $(\frac{3}{2}, -\frac{27}{16})$.
   (b) There is a local maximum at $(3, 27)$.
   (c) There is a stationary point of inflection at $(0, 0)$.
   (d) There is a global minimum at $(-1, 3)$.
   (e) There is a local minimum at $(0, 0)$.

2. Which of the statements below correctly match the function with its derivative?
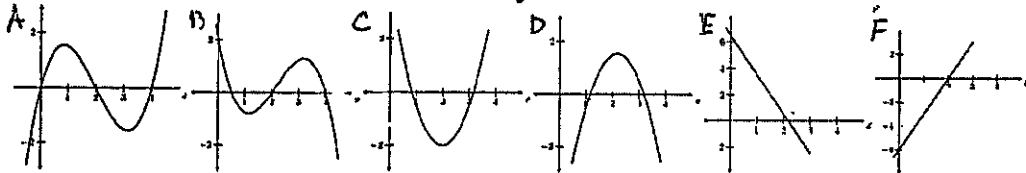
   (a) C is the graph of the derivative of B
   F is the graph of the derivative of C
   D is the graph of the derivative of A
   E is the graph of the derivative of D.

   (b) A is the graph of the derivative of C
   C is the graph of the derivative of F
   B is the graph of the derivative of D
   D is the graph of the derivative of E

   (c) C is the graph of the derivative of A
   E is the graph of the derivative of C
   D is the graph of the derivative of B
   F is the graph of the derivative of D.

   (d) C is the graph of the derivative of A
   F is the graph of the derivative of C
   D is the graph of the derivative of B
   E is the graph of the derivative of D

3. A function f is decreasing for $x \geq 2$ and $f(2) = 20$, $f'(2) = -2$ and $f''(x) > 0$ for $x \geq 2$. Which of the following is a possible value for $f(4)$?
   (a) $f(4) = 16$　(b) $f(4) = 18$　(c) $f(4) = 20$　(d) $f(4) = 22$　(e) $f(4) = 24$

4. Which one of the following statements is correct?
   (a) if $f(t) = 5^t$ then $f'(t) = \frac{1}{\ln 5} 5^t$.
   (b) if $f(x) = x^{-3}$ then $f'(x) = -3x^{-2}$.
   (c) if $f(z) = \frac{1}{z} - \frac{2}{z^2}$ then $f'(z) = 1 - \frac{1}{z}$.
   (d) if $y = x^3 + 3x^2 + 5$ then $\frac{dy}{dt} = 3x^2 + 6x + 5$.
   (e) if $y = \frac{1}{\sqrt{t}}$ then $\frac{dy}{dt} = \frac{-1}{2\sqrt{t^3}}$.

5. Suppose $f(x, y) = x^3 e^{xy}$ Which one of the following statements is correct?
   (a) $\frac{\partial f}{\partial x} = 3x^2 e^{xy} + x^3 y e^{xy}$ and $\frac{\partial f}{\partial y} = x^4 e^{xy}$.
   (b) $\frac{\partial f}{\partial x} = 3x^3 y e^{xy}$ and $\frac{\partial f}{\partial y} = 3x^3 e^{xy}$.
   (c) $\frac{\partial f}{\partial x} = 3x^2 e^{xy} + x^4 e^{xy}$ and $\frac{\partial f}{\partial y} = x^3 y e^{xy}$.
   (d) $\frac{\partial f}{\partial x} = 3x^2 e^{xy}$ and $\frac{\partial f}{\partial y} = x^3 e^{xy}$.
   (e) $\frac{\partial f}{\partial x} = 3x^2 e^{xy} + x^2 y e^{xy}$ and $\frac{\partial f}{\partial y} = x^4 e^{xy}$.

6. Which one of the following has not been differentiated correctly?

   (a) if $f(t) = e^{x^2+5}$ then $f'(t) = 2xe^{x^2+5}$.

   (b) if $h(x) = \sqrt{x^2+5}$ then $h'(x) = \frac{x}{\sqrt{x^2+5}}$.

   (c) if $f(z) = \frac{1}{(z^2+2z+1)^2}$ then $f'(z) = \frac{3z^2+2}{(z^2+2z+1)^3}$.

   (d) if $h(x) = (2x^4+e^x)^3$ then $h'(x) = 3(8x^3+e^x)(2x^4+e^x)^2$.

   (e) if $y = \sqrt[3]{(2x^2+3x+1)^2}$ then $\frac{dy}{dt} = \frac{2(2x+3)}{3\sqrt[3]{2x^2+3x+1}}$.

7. Which one of the following statements is correct?

   (a) $\lim_{x\to\infty}\frac{x^2+e^x}{x+e^x} = \infty$ (b) $\lim_{x\to1}\frac{1-x}{e^x-e} = -e^{-1}$ (c) $\lim_{x\to0}\frac{\sin x^2}{x} = 1$ (d) $\lim_{x\to1^-}\frac{\sqrt{1-x^2}}{x-1} = -1$ (e) $\lim_{x\to1}\frac{\ln x}{x-1} = 0$

8. Find $\lim_{n\to\infty}(-1)^n(\frac{n+1}{n})$

   (a) 1   (b) −1   (c) ∞   (d) −∞   (e) None of the above

9. Find an expression for the area from 5 to 7 under the curve $y = x^3$ as a limit.

   (a) $\lim_{n\to\infty}\sum_{i=1}^{n}(5+\frac{3i}{n})^3\frac{4}{n}$.

   (b) $\lim_{n\to\infty}\sum_{i=1}^{n}(5+\frac{4i}{n})^3\frac{1}{n}$.

   (c) $\lim_{n\to\infty}\sum_{i=1}^{n}(5+\frac{5i}{n})^3\frac{3}{n}$.

   (d) $\lim_{n\to\infty}\sum_{i=1}^{n}(5+\frac{2i}{n})^3\frac{2}{n}$

   (e) $\lim_{n\to\infty}\sum_{i=1}^{n}(5+\frac{3i}{n})^3\frac{3}{n}$

10. Evaluate the definite integral $\int_{-\frac{\pi}{4}}^{\frac{\pi}{4}}\frac{x^2\sin x}{5+x^6}dx$.

    (a) 0   (b) -2   (c) 0.1   (d) 1   (e) 3

11. Find (approximately) the area of the region bounded by the curves
    $$y = 4+x^2, \quad y = 4+e^{-x^2}$$
    (a) $S = 1.01$ (b) $S = 0.96$ (c) $S = 0.98$ (d) $S = 0.99$ (e) $S = 0.97$

12. Evaluate the integral $\int_0^1 x^3 e^{-x^4}dx$.

    (a) $\frac{1}{5}(1-e)$ (b) $\frac{1}{4}(e^{-1}-1)$ (c) $\frac{1}{4}(1-e^{-1})$ (d) $4(1-e^{-1})$ (e) $5(1-e^{-1})$

13. Find $\lim_{x\to-\infty} x^3 e^x$.

    (a) −∞   (b) 0   (c) 1/3   (d) 3   (e) ∞

14. Evaluate the definite integral $\int \sin^3 2x \cos 2x \, dx$.

   (a) $-\frac{1}{10}\cos^5 2x + \frac{1}{6}\cos^3 2x + C$.

   (b) $\frac{1}{10}\cos^5 2x - \frac{1}{6}\cos^3 2x + C$.

   (c) $-\frac{1}{10}\sin^5 2x - \frac{1}{6}\sin^3 2x + C$.

   (d) $-\frac{1}{10}\sin^5 2x + \frac{1}{6}\sin^3 2x + C$

   (e) $10\sin^5 2x + 6\sin^3 2x + C$

15. Find the solution of the differential equation $x + 4y^3\sqrt{x^2+1}\dfrac{dx}{dy} = 0$ that satisfies the initial condition $y(0) = 6$.

   (a) $y = \sqrt[4]{1296 + \sqrt{x^2+1}}$.

   (b) $y = \sqrt[4]{1297 - \sqrt{x^2-1}}$.

   (c) $y = \sqrt[4]{1297 + \sqrt{x^2+1}}$.

   (d) $y = \sqrt[4]{1296 - \sqrt{x^2+1}}$

   (e) $y = \sqrt[4]{1297 - \sqrt{x^2+1}}$

16. Determine whether the series is convergent or divergent. If it is convergent, find its sum. $\displaystyle\sum_{n=1}^{\infty} \frac{4^n + 7^n}{28^n}$

   (a) divergent   (b) $\dfrac{7}{4}$ (c) $\dfrac{4}{7}$ (d) $\dfrac{1}{2}$ (e) $\dfrac{9}{28}$

17. Find the Maclaurin series of $f(x) = x\cos(2x)$.

   (a) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n 2^n x^{2n+1}}{(2n)!}$.

   (b) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n} x^{2n}}{(2n)!}$.

   (c) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^{n+1} 2^n x^{2n+1}}{(2n)!}$

   (d) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n} x^{2n+1}}{(2n)!}$

   (e) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^n 2^{2n} x^{2n+1}}{n!}$

18. Calculate the double integral $\displaystyle\iint_R \frac{xy^2}{x^2+1}\,dA$, $R = \{(x,y) \mid 0 \le x \le 4, -3 \le y \le 3\}$.

   (a) $7\ln 5$ (b) $7\ln 17$ (c) $9\ln 17$ (d) $9\ln 5$ (e) $6\ln 17$

國 立 雲 林 科 技 大 學
96學年度碩士班入學招生考試試題

系所：工管所
科目：計算機概論

1. 請說明以下名詞或概念(24%)

    (1) Computer variable
    (2) Class and Object
    (3) Encapsulation
    (4) Multithreading
    (5) ODBC
    (6) SQL
    (7) Linked list
    (8) Web 2,0

2. 類別(Class)設計(26%)

    「複數」(Complex)具有實數與虛數兩部分，以 realPart + imaginaryPart * i

    表示，此處 $i = \sqrt{-1}$。請以任何物件導向程式語言設計「複數」類別，包括

    其「屬性」 (attribute)及下列成員函數(Member function)或方法(Method)，

    成員函數或方法應有完整的回傳結果型態、參數型態、與處理程式：

    (1) add(cobj)：令該複數物件加上複數物件 cobj，產生一新複數(和)並傳回。
    (2) subtract(cobj)：令該複數減去複數物件 cobj，產生一新複數(差)並傳回。
    (3) multiply(cobj)：令該複數乘上複數物件 cobj，產生一新複數(積)並傳回。
    (4) divide(cobj)：令該複數除以複數物件 cobj，產生一新複數並傳回。
    (5) print( )：以 $a+bi$ 文字格式在標準輸出裝置顯示該複數。
        [Note：$i^2 = -1$]

3. 請說明 P2P(Peer to Peer, 點對點技術)的運作方式，以及請討論對相關產業/
   領域所帶來的影響/衝擊/問題。 (15%)

4. 請討論 Web 2.0 對相關產業/領域所帶來的影響/衝擊/問題(註：可省略此題名
   詞解釋的部分)。(20%)

5. 請說明 Wikipedia (維基百科) 對相關產業/領域所帶來的影響/衝擊/問題。
   (15%)

1 (10%) The past demand information of a product indicated that the demand was in a very stable condition. If a planner want to apply the simple exponential smoothing method for forecasting the demand of the next year (by month), what is the α coefficient should be suggested. Please state your reasons.

2. (15%) Please state the difference between two production planning strategies, level capacity strategy and chase demand strategy. State the environments (conditions) that each strategy can be applied.

3. (20%) A product has a reorder point of 260 units, and is ordered ten times a year. The following table shows the historical distribution of demand values observed during the reorder period.

Demand	Probability
240	.1
250	.2
260	.4
270	.2
280	.1

Currently, stockouts are valued at $5 per unit per occurrence, while inventory carrying costs are $2 per unit per year. Should the firm add safety stock? If so, how much safety stock should be added?

4. (15%) For a three machine flow shop scheduling problem, the job information is described as below. Please find the optimal job sequence that minimizes the makespan, and state your reasons.

Job	MC#1	MC#2	MC#3
A	8	2	3
B	6	4	6
C	5	1	3
D	9	3	5

5. (10%) For a single machine scheduling problem, what is the dispatching rule that will minimize the mean job lateness. Please state your reasons.

6. (10%) For a 10 activities simple project, the completion time is 50 (days) calculated by both CPM and PERT techniques. Please answer the following problems.
(a) For a CPM method, what is the probability that the project is finished on 50 days.
(b) For a PERT method, what is the probability that the project is finished on 50 days.

7. (20%) Consider the MPS, BOM, and inventory data shown. Please construct the MRP schedule using the following information.

<u>Master Production Schedule:</u> The following table shows the MPS .

Finished Item A	1	2	3	4	5	6	7	8
Finished Item A MPS	20		40	30		20		40

<u>Bill of Material:</u>

-Item A uses 2 each of component D, 1 each of component C and 2 each of subassembly B.

-Subassembly B uses 2 each of component E.

<u>Selected Inventory Data:</u>

Item	Lot Size Technique	Lead Time	Scheduled Receipts	On-Hand
B	Lot-for-Lot	1	40 in period 1	
C	Fixed Period (3 Periods)	2		40
D	Fixed Order Quantity (250)	1	.	100
E	Lot-for-Lot	2	160 in period 2	

Choose a correct answer for each question. Two points for each question.

1. According to the theory of comparative advantage, specialization and free trade will benefit
(A) all trading parties under certain circumstances.
(B) all trading parties, even when some are absolutely more efficient producers than others.
(C) only that trading party that has an absolute advantage in the production of all goods.
(D) only that trading party that has a comparative advantage in the production of all goods.

2. A change in income, preferences, or prices of other goods or services leads to a
_____ that causes a _____.
(A) change in demand; movement along the demand curve
(B) change in quantity demanded; movement along the demand curve
(C) change in demand; shift of the demand curve
(D) change in quantity demanded; shift of the demand curve

3. In college you practically existed on instant noodles, but now you earn $95,000 a year. You never want to see instant noodles again. We can safely conclude that you consider instant noodles to be a(n)
(A) normal good.
(B) complementary good.
(C) luxury.
(D) inferior good.

4. A decrease in demand for cameras would likely be caused by
(A) an increase in the price of a substitute good.
(B) an increase in the price of cameras.
(C) an increase in the price of a complementary good.
(D) a decrease in the price of cameras.

5. If the market price of rice is $5.00 per pound but the government will not allow rice farmers to charge more than $1.00 per pound of rice, which of the following will happen?
(A) Demand must eventually decrease so that the market will come into equilibrium at a price of $1.50.
(B) There will be a shortage of rice.
(C) Supply must eventually increase so that the market will come into equilibrium at a price of $1.50.
(D) The market will be in equilibrium at a price of $1.00.

6. Consumer surplus will be zero at any quantity if

(A) supply is perfectly elastic.

(B) supply is perfectly inelastic.

(C) demand is perfectly elastic.

(D) demand is perfectly inelastic.

7. At a price of $11, quantity demanded is 90; and at a price of $9, quantity demanded is 110. Using the midpoint formula, the price elasticity of demand is

(A) 0.0.

(B) 82.

(C) -1.0.

(D) -1.22.

8. The government is considering placing a tax on cigarettes to raise revenue to finance health care benefits. One of the arguments for this tax is that the demand for cigarettes is price inelastic. Which of the following statements is TRUE?

(A) The tax on cigarettes may not raise as much revenue as anticipated in the years to come because the demand for cigarettes is likely to become more elastic over time.

(B) This is a very good way to raise revenue both in the short term and in the long term because there are no substitutes for cigarettes.

(C) This tax will not raise much revenue either in the short term or the long term because demand is price inelastic.

(D) No tax revenue can be raised in this way because sellers of cigarettes will just lower their price by the amount of the tax and therefore the price of cigarettes to consumers will not change.

9. Richard is consuming X and Y so that $MU_x/P_x = 6$ and $MU_y/P_y = 10$. To maximize utility, Richard should

(A) continue to consume the same amount of X and Y, as the consumer is already maximizing utility.

(B) consume less of both X and Y.

(C) consume more X and less Y.

(D) consume less X and more Y.

10. Assuming that charitable giving is a normal good, the income effect of a decrease in personal tax rates should

(A) lead to less giving because giving to charity would become more expensive relative to

other goods.

(B) lead to more giving because giving to charity would become less expensive relative to other goods.

(C) lead to more giving because households would have more disposable income.

(D) lead to less giving because households would spend that money on luxury goods

11. Assume leisure is an inferior good instead of a normal good. The income effect of a wage increase will lead to a _____ demand for leisure and a _____ labor supply.

(A) lower; higher

(B) higher; higher

(C) lower; lower

(D) higher; lower

12. You own a building that has four possible uses: a cafe, a craft store, a hardware store, and a bookstore. The value of the building in each use is $2,000; $3,000; $4,000; and $5,000, respectively. You decide to open a hardware store. The opportunity cost of using this building for a hardware store is

(A) $2,000, the value if the building is used as a cafe.

(B) $3,000, the value if the building is used as a craft store.

(C) $10,000, the sun of the values if the building is used for a cafe, a craft store, or a bookstore.

(D) $5,000, the value if the building is used for a bookstore.

13. Assume the wool industry is a perfectly competitive industry. The market demand curve for wool is _____ and each individual wool producer's demand curve is _____ .

(A) downward sloping; horizontal

(B) horizontal; downward sloping

(C) horizontal; horizontal

(D) downward sloping; downward sloping

14. If a firm's demand curve is perfectly elastic, then at the profit maximizing level of output

(A) $P = MR = MC$.

(B) $P > MR > MC$.

(C) $P < MR < MC$.

(D) $P > 0$ and $MR = 0$.

15. Billy Bob's Fertilizer Engineers, a perfectly competitive firm, is incurring a loss but still

earning an operating profit. Then in the short run this firm should _____ and in the long run, if there is no change in economic conditions, this firm should _____.

(A) shut down; exit the industry

(B) shut down; expand

(C) produce where MR = MC; exit the industry

(D) produce where MR = MC; expand

16. Perfect price discrimination

(A) is charging different prices to different buyers.

(B) is an attempt by monopolists to capture consumer surplus as profit.

(C) can eliminate the deadweight loss to society of a monopoly.

(D) do all of the above.

17. The pizza delivery industry is monopolistically competitive. Little Joe's Pizzeria raises its prices by 10%, but all the other pizzerias in town keep their prices the same. Which of the following is most likely to occur?

(A) Little Joe's Pizzeria will not be able to sell any pizzas, because it was the only firm to raise its price.

(B) Little Joe's Pizzeria will lose some of its customers.

(C) Little Joe's Pizzeria's profits will increase.

(D) The number of customers served by Little Joe's Pizzeria will increase.

18. If a subsidy is granted to perfectly competitive firms that provide external benefits to society, the firm's marginal cost curve will shift _____ and the industry supply curve will shift to the _____.

(A) down; left

(B) down; right

(C) up; right

(D) up; left

19. There would be no excess burden from a tax if demand were

(A) unitarily elastic.

(B) perfectly elastic.

(C) perfectly inelastic.

(D) upward sloping.

20. Which of the following illustrates the principle of second best?

(A) The government imposes taxes on gasoline and the tax revenue collected is used to pay

for road repair.

(B) The government decides to impose taxes on all grains, rather than imposing a tax only on wheat.

(C) The government imposes a tax on a paper manufacturer that equals the cost of cleaning the river damaged by the waste discharged into the river by the paper manufacturer.

(D) A tax imposed on land, because this tax distorts economic decisions less than taxes on other factors of production.

21. Suppose that the United States and Italy both produce wine and shoes. In the United States, wine sells for $10 a bottle and shoes sell for $40 a pair. In Italy, wine sells for 12,000 lira a bottle and shoes sell for 18,000 lira a pair. If the current exchange rate is 1,000 lira to the dollar, then

(A) Italy will import both shoes and wine from the United States.

(B) the United States will import both shoes and wine from Italy.

(C) the United States will import shoes from Italy and Italy will import wine from the United States.

(D) the United States will import wine from Italy and Italy will import shoes from the United States.

22. The demand curve faced by a monopolistic competitor is likely to be

(A) less elastic than the demand curve faced by a perfectly competitive firm and less elastic than the demand curve faced by a monopoly.

(B) less elastic than the demand curve faced by a perfectly competitive firm and more elastic than the demand curve faced by a monopoly.

(C) more elastic than the demand curve faced by a perfectly competitive firm and less elastic than the demand curve faced by a monopoly.

(D) more elastic than the demand curve faced by a perfectly competitive firm and more elastic than the demand curve faced by a monopoly.

23. If a firm's production process exhibits decreasing returns to scale for all levels of output, then the firm's long-run average cost curve will be

(A) horizontal.

(B) positively sloped.

(C) negatively sloped.

(D) U-shaped.

24. If the competitive firm suddenly notices that price exceeds marginal cost, the firm will

(A) increase output.

(B) decrease output.

(C) be maximizing profits.

(D) raise its price.

25. Which of the following statements about the short run is TRUE?

(A) Labor may be the fixed factor.

(B) In terms of chronological time, it could be as short as two weeks.

(C) Firms can curtail operations but cannot go completely out of business.

(D) All of the above

26. Which of the following will cause a rightward shift in the money demand curve?
   A. a reduction in income
   B. an increase in the money supply
   C. a reduction in the interest rate
   D. none of the above

27. Which of the following statements is consistent with a given (i.e., fixed) IS curve?
   A. A reduction in the interest rate causes investment spending to increase.
   B. An increase in government spending causes an increase in demand for goods.
   C. An increase in taxes causes a reduction in demand for goods.
   D. A reduction in the interest rate causes an increase in the money supply.

28. Suppose investment spending is NOT very sensitive to the interest rate. Given this information, we know that:
   A. the LM curve should be relatively steep.
   B. the LM curve should be relatively flat.
   C. the IS curve should be relatively steep.
   D. the IS curve should be relatively flat.

29. Suppose there is a central bank purchase of bonds and simultaneous tax cut. We know with certainty that this combination of policies must cause:
   A. an increase in the interest rate.   B. a reduction in interest rate.
   C. an increase in output.   D. a reduction in output.

30. Which of the following will occur if there is a reduction in consumer confidence?
   A. The LM curve will shift up.
   B. The IS curve will shift rightward.
   C. The IS curve will shift leftward.
   D. The LM curve will shift down.

31. Suppose fiscal policy makers implement a policy to reduce the size of a budget deficit. Based on the IS-LM model, we know with certainty that the following will occur in the short run as a result of this fiscal policy action.
    A. Investment spending will increase.
    B. Investment spending will decrease.
    C. There will be no change in investment spending.
    D. Investment spending may increase, decrease, or not change.

32. Suppose the economy is operating at a point where output is less than the natural level of output. Which of the following statements is correct given this information?

    A. the price level is less than the expected price level
    B. the unemployment rate is less than the natural unemployment rate
    C. the price level will be higher next period than this period
    D. all of the above

33. Which of the following would reduce the short-run output effects of a monetary expansion?
    A. The IS curve is very steep
    B. a reduction in the interest rate sensitivity of investment
    C. a reduction in the marginal propensity to consume
    D. all of the above

34. Assume the economy is initially operating at the natural level of output. Now suppose a budget is passed that calls for a tax cut. This fiscal expansion will, in the *medium* run, have no effect on which of the following?
    A. the price level
    B. the interest rate
    C. employment
    D. all of the above

35. Assume the economy is initially operating at the natural level of output. Suppose that individuals decide to increase their saving. We know that this increased desire to save will be "neutral" in:
    A. neither the medium run nor the short run.
    B. both the short run and the medium run.
    C. the short run, but not the medium run.
    D. the medium run, but not the long run.

36. For this question, assume that the economy is initially operating at the natural level of output. A reduction in consumer confidence will cause:
    A. ambiguous effects on the real wage in the medium run.
    B. no change in the real wage in the medium run.
    C. an increase in the real wage in the medium run.
    D. a reduction in the real wage in the medium run.

37. In the aggregate demand relation, a reduction in the price level causes output to increase because of its effect on:
    A. the expected price level.
    B. the interest rate.
    C. government spending.
    D. firms' markup over labor costs.

38. Assume the economy is initially operating at the natural level of output. Which of the following events will initially cause a shift of the aggregate supply curve?
    A. an increase in the money supply
    B. an increase in consumer confidence
    C. an increase in government spending
    D. none of the above

39. A reduction in the price of oil will tend to cause which of the following?
    A. no change in the interest rate in the medium run
    B. an increase in investment in the medium run
    C. an increase in the aggregate price level as output increases
    D. no change in the real wage in the medium run

40. For this question, assume that the expected rate of inflation is a function of past year's inflation. Also assume that the unemployment rate has been equal to the natural rate of unemployment for a number of years. Given this information, we know that:
    A. the rate of inflation should neither increase nor decrease.
    B. the rate of inflation will approximately be equal to zero.
    C. the rate of inflation should steadily increase over time.
    D. the rate of inflation should steadily decrease.

41. Which of the following would be most likely to cause a change in the natural rate of unemployment?
    A. changes in monetary policy
    B. changes in the rate of inflation
    C. changes in the price of oil
    D. changes in fiscal policy

42. The "Lucas critique" is that:
    A. macro data based on government surveys is inaccurate.
    B. policy changes affect expectations, which in turn affect the impact of the policy.
    C. increasing unemployment to reduce inflation is more costly to society than economists traditionally think.
    D. policy changes can affect the economy only when they are expected.

43. For this question, assume that there are decreasing returns to capital, decreasing returns to labor, and constant returns to scale. An increase in the capital stock will cause which of the following?
    A. not change in output
    B. an increase in output per capita
    C. a reduction in output
    D. decrease the capital-labor ratio

44. Suppose there are two countries that are identical with the following exception. The saving rate in country A is greater than the saving rate in country B. Given this information, we know that in the long run:
    A. the capital-labor ratios will be the same in both countries.
    B. the growth rate of output per capita will be the same in both countries.
    C. the growth rate of output per capita will be greater in B than in A.
    D. the growth rate of output per capita will be greater in A than in B.

45. "Convergence" has been occurring among the OECD countries because:
    A. the poorer countries have had higher growth rates than the richer ones.
    B. the richer countries give away more of their output than the poorer ones.
    C. the richer countries have had higher growth rates than the poorer ones.

D. the procedures for measuring output per capita have been changing.

46. Suppose a recent budgetary policy results in a reduction in the national saving rate. Such a change in the saving rate will NOT affect which of the following variables in the long run?
    A. the level of investment
    B. output per worker
    C. capital per worker
    D. none of the above

47. For this question assume that technological progress does not occur. In Japan, the rate of saving has generally been greater than in the U.S. Given this information, we know that in the long run:
    A. Capital per worker in Japan will be no different than U.S. capital per worker.
    B. Japan's growth rate will be greater than the U.S. growth rate.
    C. Output per worker in Japan will be greater than U.S. output per worker.
    D. all of the above

48. Which of the following represents a dimension of technological progress?
    A. a larger variety of products
    B. new products
    C. larger quantities of output for given quantities of capital and labor
    D. all of the above

49. Assume that the production function for an economy is represented by the following: $Y = N \cdot A$, where Y denotes the quantity of output, N denotes the number of workers, and A denotes the state of technology. Now assume the economy experiences an increase in productivity (i.e., an increase in A). This increase in productivity will cause:
    A. the aggregate supply curve to shift downward, and have an ambiguous effect on the aggregate demand curve.
    B. the aggregate supply curve to shift downward and the aggregate demand curve to shift leftward.
    C. the aggregate supply curve to shift downward and the aggregate demand curve to shift rightward.
    D. the aggregate supply curve to shift upward, but has no effect on the aggregate demand curve.

50. Suppose workers' expectations of the price level and productivity are accurate. For this economy, an increase in productivity will cause which of the following?
    A. a decrease in the real wage and an increase in the natural rate of unemployment
    B. an increase in the real wage and a decrease in the natural rate of unemployment
    C. an increase in both the real wage and the natural rate of unemployment
    D. none of the above