

Mathematics 1307 Sample Placement Examination

1. The two lines described in the following equations intersect at a point. What is the value of $x+y$ at this point of intersection?

$$5x - y = 9$$

$$x - 2y = 4$$

- A) $-1/6$ B) $-1/3$ C) 0 D) $1/3$ E) $1/6$
2. Consider the following linear programming problem. Which of the points listed is NOT a corner of the feasible region?

Maximize: $P = 10x - 3y$

Subject to:

$$x + 2y \geq 8 \quad (\text{L1})$$

$$2x + y \geq 10 \quad (\text{L2})$$

$$x, y \geq 0$$

- A) (0, 10) B) (0, 4) C) (4, 2) D) (8, 0) E) All points listed are corner points
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The linear programming problems in problems 3 and 4 have the following common corner table and feasible region.

Corner Table

Label	x	y	P	C
A	0	16		
B	4	8		
C	10	2		
D	14	0		

3. Consider the following linear programming problem.

Maximize: $P = -4x - y$

Subject to:

$$2x + y \geq 16 \quad (\text{L1})$$

$$x + y \geq 12 \quad (\text{L2})$$

$$x + 2y \geq 14 \quad (\text{L3})$$

$$x, y \geq 0$$

What is the label associated with the corner which is the solution of this linear programming problem? If the linear programming problem has no solution, then report the answer to be E.

- A) A B) B C) C D) D E) E
4. Consider the following linear programming problem.

Minimize: $C = +4x - y$

Subject to:

$$2x + y \geq 16 \quad (\text{L1})$$

$$x + y \geq 12 \quad (\text{L2})$$

$$x + 2y \geq 14 \quad (\text{L3})$$

$$x, y \geq 0$$

What is the label associated with the corner which is the solution of this linear programming problem? If the linear programming problem has no solution, then report the answer to be E.

- A) A B) B C) C D) D E) E
-

5. What is the total amount due on a loan of \$1500 at 12% simple interest at the end of 4 months?
- A) \$1500 B) \$1515 C) \$1530 D) \$1545 E) \$1560
6. How many months will it take \$10,000 to grow to \$15,000 if it is invested at 9% compounded monthly? Be sure to round your answer up to the next larger integer.
- A) 46 B) 49 C) 52 D) 55 E) 58
7. Assume that you buy a television set for \$800 and agree to pay for it in 18 equal monthly payments at 18% interest on the unpaid balance. Which of the following best estimates how much interest you will pay?
- A) \$119 B) \$128 C) \$138 D) \$148 E) \$158
8. Which of the following best estimates the value of an annuity at the end of 5 years if \$100 per month is deposited into an account earning 9% compounded monthly?
- A) \$7,502 B) \$7,522 C) \$7,542 D) \$7,562 E) \$7,582
9. How many four-letter code words are possible using the first six letters of the alphabet if no letter can be repeated?
- A) 24 B) 360 C) 480 D) 720 E) 1296
10. There are eight teams in a conference. How many games must be scheduled if each team is to play every other team exactly once?
- A) $C_{8,2}$ B) $C_{6,2}$ C) $P_{8,2}$ D) $P_{6,2}$ E) $P_{8,6}$
-

For the next two problems consider the following scenario. A carton of twenty calculator batteries contains exactly two dead batteries. A random sample of three batteries is selected from the carton and tested.

11. How many samples can be selected?
- A) 6 B) 1140 C) 2280 D) 6840 E) 8000
12. How many of these samples will contain exactly one dead battery?
- A) 2 B) 153 C) 306 D) 612 E) 1140
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For the next two problems consider the following experiment. One urn has four red and two white balls; a second urn has one red and five white balls. A single fair die is rolled and if 2 or 5 dots show, a ball is drawn out of the first urn; otherwise a ball is drawn out of the second urn.

13. What is the probability of drawing a red ball?
- A) $4/36$ B) $8/36$ C) $12/36$ D) $20/36$ E) $24/36$

14. If a red ball is drawn, what is the probability that it came from the first urn?

- A) $2/12$ B) $4/12$ C) $6/12$ D) $8/12$ E) $10/12$
-

For the next two problems consider the following scenario. An insurance company found in a particular community that 30% of the drivers involved in an accident one year were also involved in an accident the following year, while only 10% of the drivers not involved in an accident one year were involved in an accident the following year.

15. Suppose that 20% of the drivers in this community were involved in an accident in 2002. What percentage of the drivers would you expect to be involved in an accident in 2003?

- A) 6% B) 8% C) 10% D) 12% E) 14%

16. At steady state, let P denote the probability that a driver will have an accident and Q denote the probability that a driver will not have an accident. Which set of equations, when solved, would lead to the correct determination of the values of P and Q ?

- A) $0.3P + 0.7Q = P$ B) $0.7P + 0.3Q = P$ C) $0.3P + 0.1Q = P$ D) $0.1P + 0.3Q = P$
 $0.1P + 0.9Q = Q$ $0.9P + 0.1Q = Q$ $0.7P + 0.9Q = Q$ $0.9P + 0.7Q = Q$
 $P + Q = 1$ $P + Q = 1$ $P + Q = 1$ $P + Q = 1$
- E) $0.3P + 0.9Q = P$
 $0.7P + 0.1Q = Q$
 $P + Q = 1$
-

17. Consider the following data (the values of x are to be assumed to be exact).

x	Frequency
5	4
6	5
7	3
8	1

What is the best estimate of the mean of these data?

- A) 3.25 B) 6 C) 6.08 D) 6.5 E) 6.58

18. Suppose a fair die is rolled five times. Which of the following numbers best estimates the probability that the face with three dots will be rolled at most once?

- A) 0.1962 B) 0.4019 C) 0.5981 D) 0.8038 E) 0.8333
-

For the next two problems consider the following scenario. Suppose that the weights of Texas watermelons are normally distributed with mean 100 lbs and standard deviation 10 lbs. A watermelon is picked at random.

19. What is the probability that this watermelon weighs between 97 and 103 lbs?

- A) .118 B) .226 C) .236 D) .3 E) .6

20. What is the probability that this watermelon weighs at least 106 lbs?

- A) .118 B) .226 C) .274 D) .774 E) .882

Financial Formulas

r - annual interest rate

t - time in years

$i = r/m$

m - periods per year

i - periodic interest rate

$n = mt$

Simple interest: $I = Prt$, $A = P(1+rt)$

Effective rate: $r_e = (1 + r/m)^m - 1$

Compound interest: $A = P(1 + i)^n$

Growing time: $n = \frac{\ln\left(\frac{A}{P}\right)}{\ln(1 + i)}$

Present Value Formulas:

$$PV = PMT \frac{1 - (1+i)^{-n}}{i} \quad PMT = PV \frac{i}{1 - (1+i)^{-n}}$$

Future Value Formulas:

$$FV = PMT \frac{(1+i)^n - 1}{i} \quad PMT = PV \frac{i}{(1+i)^n - 1}$$

Permutations and Combinations:

$$P_{n,r} = \frac{n!}{(n-r)!} \quad C_{n,r} = \frac{n!}{r!(n-r)!}$$

Probability:

A^* denotes the complement of the event A; $P(A^*) = 1 - P(A)$

Events A and B are mutually exclusive if $A \cap B = \emptyset$

Events A and B are independent if $P(A \cap B) = P(A) P(B)$

The odds for an event A are $\frac{P(A)}{P(A^*)}$ The odds against an event A are $\frac{P(A^*)}{P(A)}$

If the odds for A are $\frac{a}{b}$, then $P(A) = \frac{a}{a+b}$ $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$P(A | B)$ denotes the probability of the event A given B

$$P(A | B) = \frac{P(A \cap B)}{P(B)} \quad P(A \cap B) = P(A) P(B|A) = P(B) P(A|B)$$

Bayes' Formula: Let $U_1, U_2, \dots, U_n$ be n mutually exclusive events whose union is the sample space S. Let E be an arbitrary event in S such that $P(E) \neq 0$. Then

$$P(U_1|E) = \frac{P(U_1 \cap E)}{P(U_1 \cap E) + P(U_2 \cap E) + \dots + P(U_n \cap E)}$$

Statistics:

Ungrouped data: $\bar{x} = \frac{\sum x}{n}$ $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$

Grouped data: $n = \sum f$ $\bar{x} = \frac{\sum xf}{n}$ $s = \sqrt{\frac{\sum (x - \bar{x})^2 f}{n - 1}}$

Binomial Distribution:

$P(x)$ - probability of x successes in n trials p - probability of success q - probability of failure

$P(x) = C_{n,x} p^x q^{n-x}$ Mean: $\mu = np$ Standard deviation: $\sigma = \sqrt{npq}$

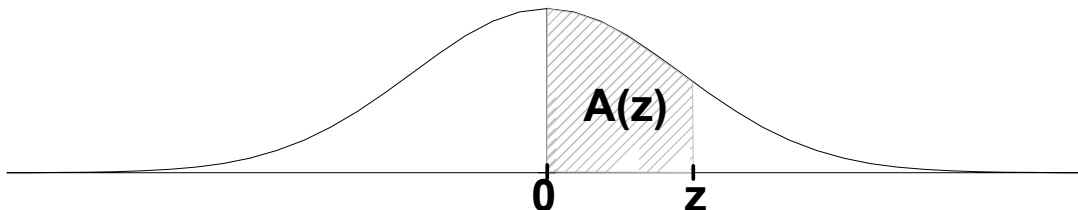
Normal distribution:

The Binomial Distribution can be approximated by the Normal Distribution when the interval from $\mu - 3\sigma$ to $\mu + 3\sigma$ lies entirely within the interval from 0 to n . In the following table, $A(z)$ represents the area under the normal curve from 0 to z .

$$z = \frac{x - \mu}{\sigma} \quad x = \mu + \sigma z$$

Areas under the Standard Normal Curve

Table entries represent the area under the standard normal curve from 0 to z for $z > 0$.



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0004	0.0008	0.0012	0.0016	0.0020	0.0024	0.0028	0.0032	0.0036
0.1	0.0040	0.0044	0.0048	0.0052	0.0056	0.0060	0.0064	0.0067	0.0071	0.0075
0.2	0.0079	0.0083	0.0087	0.0091	0.0095	0.0099	0.0103	0.0106	0.0110	0.0114
0.3	0.0118	0.0122	0.0126	0.0129	0.0133	0.0137	0.0141	0.0144	0.0148	0.0152
0.4	0.0155	0.0159	0.0163	0.0166	0.0170	0.0174	0.0177	0.0181	0.0184	0.0188
0.5	0.0191	0.0195	0.0198	0.0202	0.0205	0.0209	0.0212	0.0216	0.0219	0.0222
0.6	0.0226	0.0229	0.0232	0.0236	0.0239	0.0242	0.0245	0.0249	0.0252	0.0255
0.7	0.0258	0.0261	0.0264	0.0267	0.0270	0.0273	0.0276	0.0279	0.0282	0.0285
0.8	0.0288	0.0291	0.0294	0.0297	0.0300	0.0302	0.0305	0.0308	0.0311	0.0313
0.9	0.0316	0.0319	0.0321	0.0324	0.0326	0.0329	0.0331	0.0334	0.0336	0.0339
1.0	0.0341	0.0344	0.0346	0.0348	0.0351	0.0353	0.0355	0.0358	0.0360	0.0362
1.1	0.0364	0.0367	0.0369	0.0371	0.0373	0.0375	0.0377	0.0379	0.0381	0.0383
1.2	0.0385	0.0387	0.0389	0.0391	0.0393	0.0394	0.0396	0.0398	0.0400	0.0401
1.3	0.0403	0.0405	0.0407	0.0408	0.0410	0.0411	0.0413	0.0415	0.0416	0.0418

1.4	0.419 0.421	0.422 0.424	0.425 0.426	0.428 0.429	0.431 0.432
1.5	0.433 0.434	0.436 0.437	0.438 0.439	0.441 0.442	0.443 0.444
1.6	0.445 0.446	0.447 0.448	0.449 0.451	0.452 0.453	0.454 0.454
1.7	0.455 0.456	0.457 0.458	0.459 0.460	0.461 0.462	0.462 0.463
1.8	0.464 0.465	0.466 0.466	0.467 0.468	0.469 0.469	0.470 0.471
1.9	0.471 0.472	0.473 0.473	0.474 0.474	0.475 0.476	0.476 0.477
2.0	0.477 0.478	0.478 0.479	0.479 0.480	0.480 0.481	0.481 0.482
2.1	0.482 0.483	0.483 0.483	0.484 0.484	0.485 0.485	0.485 0.486
2.2	0.486 0.486	0.487 0.487	0.487 0.488	0.488 0.488	0.489 0.489
2.3	0.489 0.490	0.490 0.490	0.490 0.491	0.491 0.491	0.491 0.492
2.4	0.492 0.492	0.492 0.492	0.493 0.493	0.493 0.493	0.493 0.494
2.5	0.494 0.494	0.494 0.494	0.494 0.495	0.495 0.495	0.495 0.495
2.6	0.495 0.495	0.496 0.496	0.496 0.496	0.496 0.496	0.496 0.496
2.7	0.497 0.497	0.497 0.497	0.497 0.497	0.497 0.497	0.497 0.497
2.8	0.497 0.498	0.498 0.498	0.498 0.498	0.498 0.498	0.498 0.498
2.9	0.498 0.498	0.498 0.498	0.498 0.498	0.498 0.499	0.499 0.499
3.0	0.499 0.499	0.499 0.499	0.499 0.499	0.499 0.499	0.499 0.499
3.1	0.499 0.499	0.499 0.499	0.499 0.499	0.499 0.499	0.499 0.499
3.2	0.499 0.499	0.499 0.499	0.499 0.499	0.499 0.499	0.499 0.499
3.3	0.500 0.500	0.500 0.500	0.500 0.500	0.500 0.500	0.500 0.500

Answer Key

1.D 2.B 3.A 4.E 5.E 6.D 7.A 8.C 9.B 10.A 11.B 12.C
13.C 14.D 15.E 16.C 17.C 18.D 19.C 20.C

Number correct Estimated Grade
20 - 19 A
18 - 17 B
16 - 15 C

Passing grade 14 correct answers