

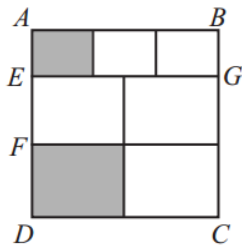
For all questions, "NOTA" stands for "None of these answers." A z-table is attached to the last page of this test and may be required to answer several questions. Unless specified in a given question, you may assume that dice, coins, or decks of cards are standard and fair.

- 1) If $P(E) = 0.5$, $P(F) = 0.25$ and $P(E \text{ or } F) = 0.75$, then events E and F must be:
A) Independent
B) Mutually exclusive
C) Both A and B
D) Neither A nor B
E) NOTA
- 2) A man has 2 quarters, 5 dimes, 3 nickels and a penny in his pocket as he approaches a toll booth. If the toll is \$0.25, what is the minimum number of coins he must take from his pocket to be sure that he will have enough money to pay the toll?
A) 2 B) 3 C) 4 D) 5 E) NOTA
- 3) What is the probability that a random point in the interior of a circle of radius 5 is more than 3 units from the center?
A) $9/25$ B) $3/5$ C) $16/25$ D) $4/5$ E) NOTA
- 4) A player tosses two fair coins. He wins \$10 if 2 tails occur, \$5 if exactly 1 tail occurs, and \$1 if no tail occurs. What are his expected earnings?
A) \$5.00 B) \$5.25 C) \$7.50 D) \$7.75 E) NOTA
- 5) In a certain company, three typists service for four departments. If the departments each send a file to the typists at random, what is the probability that every typist will receive at least one file?
A) $8/9$ B) $64/81$ C) $5/9$ D) $4/9$ E) NOTA
- 6) Which of the following is TRUE regarding binomial distributions with n trials and probability of success p ?
A) The degrees of freedom of its variance determines the number of trials that must be independent
B) The mean is equal to $n(1 - p)$
C) As p increases from 0 to 1, the variance will also increase
D) More than one of the above is true
E) NOTA

7) There are 496 employees in a company, one of whom is to be selected at random to win a car. Further, each person is equally likely to win the car. If the probability that a supervisor will be selected is $\frac{3}{16}$, how many supervisors work at the company?

- A) 16 B) 74 C) 93 D) 118 E) NOTA

8) In the figure below, ABCD is a square with an enclosed area of 576. Line segment AE is one-fourth of AD, and ABGE is divided into three equal rectangles. Line segment FD is one-half of ED, and EGCD is divided into 4 equal rectangles. If a point is randomly chosen from within square ABCD, what is the probability that the point will be from a shaded region?



- A) $\frac{13}{48}$ B) $\frac{7}{36}$ C) $\frac{11}{24}$ D) $\frac{3}{16}$ E) NOTA

9) The average (arithmetic mean) of 1, 2, 5, 9, and x is 4. The average (arithmetic mean) of 2, 3 and y is 6. What is the value of $x + y$?

- A) 16 B) 13 C) 10 D) 5 E) NOTA

10) For a certain type of computer, the length of time between charges of the battery is normally distributed with a mean of 50 hours and a standard deviation of 15 hours. John owns one of these computers. What is the probability (rounded to the nearest 5% multiple) that the length of time between charges for John's computer will be between 50 and 70 hours?

- A) 35% B) 40% C) 45% D) 50% E) NOTA

11) In the list of numbers, 6, x , 10, 2, 7, 13, and 15, the median is 10. Which of the following could NOT be the value of x ?

- A) 10 B) 11 C) 13 D) 16 E) NOTA

12) The annual salaries of employees in a large company are approximately normally distributed with a mean of \$50,000 and a variance of \$400,000,000. What percent of people (rounded to the nearest 5% multiple) earn less than \$40,000?

- A) 30% B) 40% C) 50% D) 60% E) NOTA

- 13) In a hockey competition, a player scores 80% of his shots (this ratio is constant over time). What is the probability the player will not miss until his 10th try?
- A) $(1 - .8)^9(.8)$ C) $(1 - .8)^{10}$ E) NOTA
B) $(1 - .8)^9(.2)$ D) $(1 - .2)^{10}$
- 14) Omar ordered his sister a birthday card from a company that randomly selects a card from their inventory. The company has 21 total cards in inventory. 14 of those cards are birthday cards. What is the probability that Omar is not sent a birthday card?
- A) 21/35 B) 2/3 C) 14/35 D) 1/3 E) NOTA
- 15) If $P(E) = 0.3$ and $P(D|E) = \frac{1}{4}$, what is $P(D \cap E)$?
- A) 3/40 B) 1/5 C) 3/5 D) 7/8 E) NOTA
- 16) 8 friends are randomly seated at a round table for dinner. Each seat comes with a unique bubble tea flavor, one of which is cherry. What is the chance that Amos sits at the spot where cherry bubble tea is served?
- A) 1/8! B) 1/60 C) 1/24 D) 1/8 E) NOTA
- 17) The digits 1, 3, 4, and 6 are each used once to form a 4-digit number. What is the probability that the number is divisible by 4?
- A) 1/4 B) 1/3 C) 7/24 D) 4/9 E) NOTA
- 18) Suppose a committee of 6 people is selected in a random manner from 12 people. Determine the probability that two particular people, Thelma and Fernanda, will both be selected.
- A) $\frac{6!}{12!}$ B) 5/22 C) 1/3 D) 5/11 E) NOTA
- 19) There are two sets of letters, and you are going to pick exactly one letter from each set:
Set #1 = {E, F, G, I} and Set #2 = {B, F, O, M}. What is the probability of picking at least one vowel?
- A) 5/16 B) 7/16 C) 5/8 D) 7/8 E) NOTA

20) Suppose the scores on this test are approximately normally distributed with an average of 60 points and a standard deviation of 15 points. In order to qualify for a trophy, a student's score must be in the 85th percentile. What's the minimum score that a student must have (assuming scores must be integers) in order to win a trophy?

- A) 64 B) 65 C) 75 D) 76 E) NOTA

21) The janitor of a school regularly replaces chalk in class rooms that have run out. During one round of checking, the janitor may have to replace the chalk in several rooms. The principal has given the following probabilities to the number of rooms (identified by the random variable C) that need to their chalk replaced on one round of checking:

C	0	1	2	3	4
$P(C = c)$	30%	20%	35%	5%	10%

If a janitor usually brings enough chalk for 8 rooms on one round of checking, how many rooms' worth of chalk are left on average after replacing those rooms that ran out (rounded to the nearest number of rooms)?

- A) 4 B) 5 C) 6 D) 7 E) NOTA

22) A square grid is composed of 100 squares with each side having length 16. A circular disk of diameter 4 is thrown at the grid, and the disk's center lands on the grid. What is the probability that the disk is not crossing the side of any square within the grid? Assume the sides are of negligible width.

- A) $3/20$ B) $7/16$ C) $9/16$ D) $49/64$ E) NOTA

23) Danyal has a pink, fluffy key chain that he needs to place 5 keys on. In how many ways can Danyal place his five keys on the key chain? Only count configurations that are distinguishable from any other configuration.

- A) 120 B) 60 C) 24 D) 12 E) NOTA

24) It has been determined that at a certain intersection, cars arriving from the west go straight 10% of the time, turn left 70% of the time, and turn right 20% of the time. It is also known that 80% of drivers use their signals regularly (you can assume always) while 20% use them rarely (you can assume never). You, who are heading into the intersection from the west, are sitting behind a driver who does not have his signal on. What is the probability that he is turning left?

- A) $1/2$ B) $5/9$ C) $3/5$ D) $7/9$ E) NOTA

Questions 25 – 28 are related. Information from previous questions made be used in subsequent ones.

25) You have a fair die that you roll once. Whatever value the die shows once rolled is how much money you win. What is the expected value of the amount of money you win in this game?

- A) 3 B) 3.5 C) 4 D) 4.5 E) NOTA

26) Let's make this game more fun! Assume the same conditions as above, except now you have the option to re-roll after the first throw if you don't like the outcome. The caveat is that you must keep that value even if it is lower than the first roll. Assuming you will keep what you rolled first if it is higher than the expected value and roll again if what you rolled first is lower than the expected value, what is the expected value of the amount of money you win in this game (rounded to the nearest tenths place)?

- A) 3.9 B) 4.1 C) 4.2 D) 4.4 E) NOTA

27) Let's make the game even more fun!! Assume the same conditions as in question #26, but now you have the chance to re-roll up to two times. The caveat is that once you re-roll, all previous values are irrelevant. You will again stop at any point when you roll above the expected value of a roll and continue on if you roll below the expected value of a roll. How does the expected value of your winnings in this game compare to the expected value of your winnings in the game described in question #26?

- A) The expected values are equal
B) The expected value of your winnings in this game is lower
C) The expected value of your winnings in this game is higher
D) More information is needed to determine this relationship
E) NOTA

28) Now let's make the game infinitely fun!!!!!!!!!!!!!!!!!!!!!!!!!!!!!! (Sorry, I couldn't type an infinite amount of exclamation points.) Suppose we play a similar game to the one described in question #27, except now you can re-roll your dice an infinite number of times if you choose. What is the expected value of this game?

- A) 4.5 B) 5 C) 5.5 D) 6 E) NOTA

29) A gambler plays a certain game. For each play, the gambler will get \$25 if he wins and lose \$25 otherwise. Suppose that the probability to win is p , where $0 \leq p \leq 1$, and that the gambler begins playing with a fortune of \$200. What is the expected value of her wealth after n independent game plays?

A) $200 + 25np(1 - p)$

C) $200 + 25np(2p - 1)$

E) NOTA

B) $200 + 25np(1 - 2p)$

D) $200 + 25n \frac{p}{1-p}$

30) Three fair 6-sided dice are rolled, and their sum is noted. What is the probability that the sum is 10?

A) $1/16$

B) $1/10$

C) $1/9$

D) $1/6$

E) NOTA

Table of the Standard Normal Distribution

$$\phi(z) = \frac{1}{\sqrt{2\pi}} \int_0^z e^{-\frac{1}{2}t^2} dt = \text{Prob}(0 < Z < z)$$

a	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990