

Mu Alpha Theta National Convention: Denver, 2001  
Probability Topic Test – Alpha Division

1. Consider rain and wind as independent events. The probability of rain is  $\frac{3}{4}$ , of wind  $\frac{1}{4}$ .  
What is the probability of both rain and wind?  
(A) 1            (B)  $\frac{1}{4}$             (C)  $\frac{3}{16}$             (D)  $\frac{1}{2}$             (E) NOTA
  
2. In conditions of problem 1 above, what is the probability of either rain or wind (or both)?  
(A)  $\frac{13}{16}$             (B)  $\frac{7}{16}$             (C)  $\frac{11}{16}$             (D)  $\frac{1}{2}$             (E) NOTA
  
3. On planet Morg a fair 5-sided die can be constructed. If two such dice are labeled with the numbers 1-5 and tossed, what is the probability the sum of the numbers displayed is 5?  
(A)  $\frac{1}{12}$             (B)  $\frac{1}{5}$             (C)  $\frac{3}{10}$             (D)  $\frac{4}{25}$             (E) NOTA
  
4. The probability the Mariners win any baseball game is  $\frac{2}{3}$ . What is the probability they win a seven-game series in six games? Note: to win a seven-game series, a team must win four of the seven games. Once this has happened, no more games are played.  
(A)  $\frac{1}{7}$             (B)  $\frac{10}{21}$             (C)  $\frac{64}{243}$             (D)  $\frac{160}{729}$             (E) NOTA
  
5. Wally's Widget Works sends out a shipment of 72 individually packaged widgets, 6 of which are defective. If Ike the Inspector opens three packages, what is the probability at least one defective widget is found?  
(A)  $\frac{137}{852}$             (B)  $\frac{347}{1491}$             (C)  $\frac{1}{72}$             (D)  $\frac{10}{71}$             (E) NOTA
  
6. Two cards are drawn from a standard 52-card deck. What is the probability the cards are of different suits?  
(A)  $\frac{10}{17}$             (B)  $\frac{13}{17}$             (C)  $\frac{12}{17}$             (D)  $\frac{8}{17}$             (E) NOTA

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7. Jim has three blue shirts, four red shirts, and two green shirts, as well as three pairs of jeans, two pairs of khakis, and one pair of shorts. Fred has seven red shirts, four brown shirts, and six white shirts, as well as three pairs of shorts and two pairs of sweats. Jim and Fred each choose an outfit at random; what is the probability their choices are identical (in terms of color of shirts and style of legwear)?

(A)  $\frac{1}{4}$       (B)  $\frac{2}{17}$       (C)  $\frac{1}{85}$       (D)  $\frac{14}{765}$       (E) NOTA

8. Six students are seated in a row; what is the probability Mary and Jane sit next to each other?

(A)  $\frac{1}{120}$       (B)  $\frac{3}{320}$       (C)  $\frac{2}{3}$       (D)  $\frac{1}{3}$       (E) NOTA

9. Steve borrows Sean's circular keychain, which holds 3 keys. Steve promptly drops the keychain, and the keys fall off. If Steve replaces the keys on the chain, what is the probability they are placed in an order identical to the original order? Direction keys are facing does not affect order.

(A)  $\frac{1}{6}$       (B)  $\frac{1}{3}$       (C) 1      (D)  $\frac{1}{4}$       (E) NOTA

10. The probability of an American winning a medal in any one event at a track and field meet is  $\frac{2}{3}$ . If a meet has 11 events, what is the probability an American wins a medal in every event?

(A)  $\frac{3,721}{436,520}$       (B)  $\frac{381}{45,934}$       (C)  $\frac{2,048}{177,147}$       (D)  $\frac{8,191}{106,288}$       (E) NOTA

11. Four distinct numbers are chosen from the first nine natural numbers. What is the probability that 5 is the second largest of those chosen?

(A)  $\frac{4}{21}$       (B)  $\frac{5}{21}$       (C)  $\frac{10}{63}$       (D)  $\frac{16}{63}$       (E) NOTA

12. The probability of Josh having an asthma attack during a tennis match is  $\frac{1}{2}$ . If he has such an attack his probability of winning is  $\frac{1}{11}$ , otherwise it is  $\frac{8}{9}$ . What is the probability of Josh winning any tennis match?

(A)  $\frac{9}{20}$       (B)  $\frac{37}{72}$       (C)  $\frac{97}{198}$       (D)  $\frac{1}{2}$       (E) NOTA

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13. If  $f(x) = \cos(x)$ , and a real value of  $x$  is chosen at random on the interval  $-12\pi < x < 10\pi$ , what is the probability that  $f(x) > 0$ ?
- (A)  $\frac{1}{2}$             (B) 1            (C) 0            (D)  $\frac{\sqrt{3}}{3}$             (E) NOTA
14. Someone rolls three dice where you cannot see them, and states (truthfully) that there is at least one four. What is the probability the three dice sum to 12?
- (A)  $\frac{3}{91}$             (B)  $\frac{2}{13}$             (C)  $\frac{7}{54}$             (D)  $\frac{5}{34}$             (E) NOTA
15. In a horse race, the odds are 14:1 against “Fat Tom” placing. In another horse race, the odds are 20:1 against “Big Daddy” placing. What is the probability that neither horse places?
- (A)  $\frac{19}{21}$             (B)  $\frac{31}{35}$             (C)  $\frac{8}{9}$             (D)  $\frac{41}{45}$             (E) NOTA
16. Ten fair coins are tossed. What is the probability exactly 4 faces display heads?
- (A)  $\frac{105}{512}$             (B)  $\frac{1}{2}$             (C)  $\frac{63}{256}$             (D)  $\frac{81}{512}$             (E) NOTA
17. One fair coin is tossed seven consecutive times. What is the probability no two heads or tails appear consecutively?
- (A)  $\frac{1}{128}$             (B)  $\frac{1}{64}$             (C)  $\frac{3}{64}$             (D)  $\frac{3}{256}$             (E) NOTA
18. A dartboard is made up of 3 concentric circles of radii 2, 4, and 8 inches. A dart thrown will strike the board in a random location. What is the probability it will strike within the innermost circle?
- (A)  $\frac{1}{4}$             (B)  $\frac{1}{8}$             (C)  $\frac{1}{16}$             (D)  $\frac{\pi}{24}$             (E) NOTA
19. Mike and Jim are pirates on a ship with a crew of nine. Two crewmembers must be sent out in a rowboat to an island, and lots are drawn to see who must go. What is the probability neither will be forced to go?
- (A)  $\frac{4}{81}$             (B)  $\frac{1}{9}$             (C)  $\frac{7}{12}$             (D)  $\frac{7}{18}$             (E) NOTA

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20. 8 students will be placed randomly in 11 desks in a row. What is the probability no two empty desks will be adjacent?

- (A)  $\frac{34}{55}$       (B)  $\frac{2}{11}$       (C)  $\frac{28}{55}$       (D)  $\frac{3}{11}$       (E) NOTA

21. 24 chocolate chips considered to have negligible volume are mixed randomly into 32 ounces of cookie dough. The dough is then randomly divided into 4-ounce cookies. If one cookie is selected at random what is the probability (to the nearest ten-thousandth) it will have zero chips?

- (A) 0.0448      (B) 0.0139      (C) 0.0406      (D) 0.0225      (E) NOTA

22. A plane crash has one survivor, considered to have negligible size. He can survive 36 hours in cold ocean water before he must eat his disgusting survival rations. He is somewhere within a search radius of 2 miles. The Coast Guard can search 2 square miles per 24-hour day. What is the probability the survivor is found before being forced to eat his survival rations?

- (A)  $\frac{1}{3}$       (B)  $\frac{1}{\pi}$       (C)  $\frac{\pi}{6}$       (D)  $\frac{3}{4\pi}$       (E) NOTA

23. When one of Paul's "friends" receives an invitation to a party he is throwing, their probability of attending is  $\frac{1}{2}$ . If Paul invites twenty people, what is the probability (to the nearest ten-thousandth) that at least ten people attend?

- (A) 0.5554      (B) 0.5613      (C) 0.5881      (D) 0.5986      (E) NOTA

24. Six blue socks and four red socks are in drawer *A*, while three blue socks and seven red socks are in drawer *B*. A sock is drawn at random from drawer *A* and placed in drawer *B*. If two socks are then drawn at random from drawer *B*, what is the probability the two form a matching pair?

- (A)  $\frac{4}{25}$       (B)  $\frac{3}{11}$       (C)  $\frac{28}{55}$       (D)  $\frac{13}{25}$       (E) NOTA

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25. If  $f(x) = \frac{4\sqrt{3}}{3}\sin(3x+7)$  and  $x_0$  is chosen at random on the interval  $-\frac{4\pi+7}{3} < x_0 < \frac{28\pi-7}{3}$ , what is the probability that  $|f(x_0)| > \frac{2\sqrt{3}}{3}$ ?
- (A)  $\frac{\sqrt{3}}{2}$       (B)  $\frac{1}{3}$       (C)  $\frac{1}{2}$       (D)  $\frac{2}{3}$       (E) NOTA
26. Sean is stuck on the last problem of his test. At the end of each one-minute interval, he has a  $\frac{2}{3}$  probability of suddenly realizing the answer. What is the probability he has the answer after five and a half minutes?
- (A)  $\frac{242}{243}$       (B)  $\frac{2}{3}$       (C)  $\frac{241}{243}$       (D)  $\frac{164}{243}$       (E) NOTA
27. If  $f(x) = 2x^2$  and a value of  $x$  is chosen at random on the interval  $0 < x < 3$ , what is the probability that  $f(x) < 2$ ?
- (A)  $\frac{1}{2}$       (B)  $\frac{2}{3}$       (C)  $\frac{\sqrt{2}}{3}$       (D)  $\frac{1}{3}$       (E) NOTA
28. A game of poker is played in which five cards are dealt and deuces (2's) are considered wild. What is the probability (to the nearest hundred-thousandth) a player is dealt four of a kind (but not five of a kind)? Note: four of a kind means four cards of the same rank (e.g. four kings or four sevens) and one of a different rank. Suit does not matter. Some hands that would meet the criteria for this problem are 6666J and 4442A.
- (A) 0.01402      (B) 0.00687      (C) 0.00543      (D) 0.05430      (E) NOTA
29. One fair six-sided die is rolled 4 times, what is the probability the numbers are rolled in descending order? Two equal numbers cannot be placed in descending order.
- (A)  $\frac{1}{144}$       (B)  $\frac{1}{108}$       (C)  $\frac{5}{432}$       (D)  $\frac{1}{72}$       (E) NOTA

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30. Bob and Jane will each arrive at the train station at random times between one and three o'clock. Bob will wait 10 minutes; Jane will wait 20 minutes. What is the probability they will be at the station at the same time?

(A)  $\frac{1}{4}$             (B)  $\frac{1}{10}$             (C)  $\frac{67}{288}$             (D)  $\frac{63}{181}$             (E) NOTA

31. An "X" is placed on the face of one of eight slips of paper. The slips of paper are then placed face down on a table. James, John, Jack, Jim, and Joe are seated around the table. They will try to grab the slips of paper at an appointed time, and any distribution of the slips is equally likely (all of the slips will be grabbed). The person with the "X" gets a million dollars. What is the probability Joe gets the million dollars?

(A)  $\frac{71}{512}$             (B)  $\frac{1}{8}$             (C)  $\frac{1}{5}$             (D)  $\frac{49}{240}$             (E) NOTA

32. Sally's extension school offers three subjects: English, Science, and History. A student may be enrolled in one, two, or three subjects. 17 are enrolled in Science and English, 14 in History and English, and 10 in History and Science. 199 total students are enrolled, with 174 taking only one subject. If a student is chosen at random, what is the probability he is enrolled in all three subjects?

(A)  $\frac{8}{199}$             (B)  $\frac{9}{199}$             (C)  $\frac{10}{199}$             (D)  $\frac{11}{199}$             (E) NOTA

33. Cherie keeps her spices on a circular spice rack. She owns four Spice Islands brand spices, five Safeway brand spices, and three Schilling brand spices, and always stores her spices in a circle such that spices of the same brand are adjacent. How many such arrangements are possible?

(A) 8,640            (B) 17,280            (C) 34,560            (D) 103,680            (E) NOTA

34. The probability an event has occurred before a given time  $t$  is given by  $P(t) = \frac{t^2}{t^2 + 1}$  with  $t$  running from zero to infinity. What is the probability that the event has not occurred by time  $t = 6$ ?

(A)  $\frac{1}{37}$             (B)  $\frac{1}{36}$             (C)  $\frac{35}{36}$             (D)  $\frac{36}{37}$             (E) NOTA

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35. A number is chosen randomly from the fifty smallest natural numbers. What is the probability it has only 3 positive integral factors?
- (A)  $\frac{3}{50}$       (B)  $\frac{2}{25}$       (C)  $\frac{1}{10}$       (D)  $\frac{3}{25}$       (E) NOTA
36. The probability of event  $A$  occurring if event  $B$  occurs is  $\frac{1}{5}$ . The probability event  $B$  occurs if event  $A$  occurs is  $\frac{1}{3}$ . The probability of both events occurring is  $\frac{1}{8}$ . What is the probability of neither event occurring?
- (A)  $\frac{1}{4}$       (B)  $\frac{1}{8}$       (C)  $\frac{5}{12}$       (D)  $\frac{1}{3}$       (E) NOTA
37. In the conditions of problem 36 above, what is the probability event  $A$  occurs?
- (A)  $\frac{3}{8}$       (B)  $\frac{1}{4}$       (C)  $\frac{5}{8}$       (D)  $\frac{1}{3}$       (E) NOTA
38. Two coins are drawn from a bag that contains 8 quarters, 5 dimes, and 3 nickels. What is the probability that the total amount of money drawn is less than \$0.35?
- (A)  $\frac{13}{30}$       (B)  $\frac{13}{60}$       (C)  $\frac{7}{30}$       (D)  $\frac{17}{30}$       (E) NOTA
39. An apartment building has 4 units with separate mailboxes. One letter is sent to each unit, the mailman is in a hurry and thus places one letter in each box at random. What is the probability at least 3 letters are placed in the correct boxes?
- (A)  $\frac{1}{120}$       (B)  $\frac{1}{24}$       (C)  $\frac{1}{36}$       (D)  $\frac{1}{12}$       (E) NOTA
40. Three points are on vertices of an  $8 \times 8$  grid of unit squares. Point  $A$  is in the upper left corner, point  $B$  is one unit below and five units to the right of  $A$ , and point  $C$  is in the lower right corner (eight units below and eight units to the right of  $A$ ). If a path of length 16 is drawn from  $A$  to  $C$  along the gridlines, what is the probability it passes through point  $B$ ?
- (A)  $\frac{7}{143}$       (B)  $\frac{8}{143}$       (C)  $\frac{9}{143}$       (D)  $\frac{10}{143}$       (E) NOTA