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DISCRETE STRUCTURES

4. How many distinguishable permutations of the letters in the word BANANA are there?

(1) 720
(2) 120
(3) 60
(4) 360
Answer: 3

Explanation:

Number of permutation of n objects with n1 identical objects of type 1, n2 identical objects of type 2, ...and nk identical objects of type k is n! / n1!n2!....nk!

Here, first we have to count the total number of letters in it. Here it is 6.
Find out how many letters are repeating in the word. Here A is repeated 3 times. N is repeated 2 times.

So, Permutation of letter BANANA are 6! / 3!2! = 60

2. Match the following:

List-I	**List-II**
a. Absurd	i. Clearly impossible being contrary to some evident truth.
b. Ambiguous	ii. Capable of more than one interpretation or meaning.
c. Axiom	iii. An assertion that is accepted and used without a proof.
d. Conjecture	iv. An opinion Preferably based on some experience or wisdom.

Codes:

	a	b	c	d
(1)	i	ii	iii	iv
(2)	i	iii	iv	ii
(3)	ii	iii	iv	i
(4)	ii	i	iii	iv

Answer: 1

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2. Let us assume that you construct ordered tree to represent the compound proposition (~(p∧q))↔(~p∨~q). Then, the prefix expression and post-fix expression determined using this ordered tree are given as ..... and ..... respectively.
   (A) ↔~∧pq∨ ~~pq, pq∧~p~q~∨↔
   (B) ↔~∧pq∨ ~p~q, pq∧~p~q~∨↔
   (C) ↔~∧pq∨ ~~pq, pq∧~p~ ~q∨↔
   (D) ↔~∧pq∨ ~p~q, pq∧~p~~q∨↔
   Answer: B

4. What is the probability that a randomly selected bit string of length 10 is a palindrome?
   (A) 1/64 (B) 1/32
   (C) 1/8 (D) ¼
   Answer: B

4. There are three cards in a box. Both sides of one card are black, both sides of one card are red, and the third card has one black side and one red side. We pick a card at random and observe only one side.
   What is the probability that the opposite side is the same colour as the one side we observed?
   (A) 3/4 (B) 2/3
   (C) 1/2 (D) 1/3
   Answer: B

1. How many committees of five people can be chosen from 20 men and 12 women such that each committee contains at least three women?
   (A) 75240 (B) 52492
   (C) 41800 (D) 9900
   Answer: B
   Explanation:
   We must choose at least 3 women, so we calculate the case of 3 women, 4 women and 5 women and by addition rule add the results.

$$^{12}C_3 \times {}^{20}C_2 + {}^{12}C_4 \times {}^{20}C_1 + {}^{12}C_5 \times {}^{20}C_0 = \left(^{12x11x10}/_{3x2x1}\right) \times \left(^{20x19}/_{2x1}\right) + \left(^{12x11x10x9}/_{4x3x2x1}\right) \times 20 + \left(^{12x11x10x9x8}/_{5x4x3x2x1}\right) \times 1$$
$$= 220 \times 190 + 495 \times 20 + 792$$
$$= 52492$$

   Explanation:

   EulerCircuits

   HamiltonCircuit

   Bipartite Graph

   From the above definitions, we can see that (d) is false. So answer is (D).

   5. While assigning colors, if we find a neighbour which is colored with same color as current vertex, then the graph cannot be colored with 2 colors (ie., graph is not Bipartite).

   So answer is option (C).

   .

2. Consider an experiment of tossing two fair dice, one black and one red. What is the probability that the number on the black die divides the number on red die ?
   (A) 22 / 36 (B) 12 / 36
   (C) 14 / 36 (D) 6 / 36
   Answer: C

3. In how many ways can 15 indistinguishable fish be placed into 5 different ponds, so that each pond contains at least one fish ?

(A) 1001 (B) 3876
(C) 775 (D) 200
Answer: A

4. A computer program selects an integer in the set $\{k : 1 \leq k \leq 10,00,000\}$ at random and prints out the result. This process is repeated 1 million times. What is the probability that the value k = 1 appears in the printout atleast once ?

(A) 0.5 (B) 0.704
(C) 0.632121 (D) 0.68
Answer: C

25. How many cards must be chosen from a deck to guarantee that atleast

i. two aces of two kinds are chosen.
ii. two aces are chosen.
iii. two cards of the same kind are chosen.
iv. two cards of two different kinds are chosen

(A) 50, 50, 14, 5 (B) 51, 51, 15, 7
(C) 52, 52, 14, 5 (D) 51, 51, 14, 5
Answer: A

38. If n and r are non-negative integers and $n \geq r$, then p(n + 1, r) equals to

(A) P(n,r)(n+1) / (n+1-r)
(B) P(n,r)(n+1) / (n-1+r)
(C) p(n,r)(n-1) / (n+1-r)
(D) p(n,r)(n+1) / (n+1+r)
Answer: A
Explanation:
p(n, r) = n!/(n-r)!
p(n+1, r) = (n+1)!/(n+1-r)!
= (n+1) n! /(n+1-r) (n-r)!
= P(n, r)(n+1)/(n+1-r)

19. Find the number of ways to paint 12 offices so that 3 of them will be green, 2 of them pink, 2 of them yellow and the rest ones white.

(A) 55,440 (B) 1,66,320
(C) 4.790E+08 (D) 39,91,680
Answer: B

36. A test contains 100 true/false questions. How many different ways can a student answer the questions on the test, if the answer may be left blank also.

(A) $^{100}P_2$ (B) $^{100}C_2$
(C) 2^{100} (D) 3^{100}
Answer: D
Explanation:
For every question we can leave it blank or answer TRUE or answer FALSE. So, for each question we have 3 options.
So, total ways of answering the test is 3*3*3*..... 100 times = 3^{100}

45. What is the result of the following expression ?
(1&2)+(3&4)

(A) 1 (B) 3
(C) 2 (D) 0
Answer: D

40. Consider the following statements :

I. Recursive languages are closed under complementation.
II. Recursively enumerable languages are closed under union.
III. Recursively enumerable languages are closed under complementation.
Which of the above statements are true ?
(A) I only (B) I and II
(C) I and III (D) II and III
Answer: B

1.

4. Domain and Range of the function
$Y = -\sqrt{(-2x + 3)}$ is
(A) $x \geq 3/2, y \geq 0$ (B) $x > 3/2, y \leq 0$
(C) $x \geq 3/2, y \leq 0$ (D) $x \leq 3/2, y \leq 0$
Answer: D

36. X – = Y + 1 means
(A) X = X – Y + 1 (B) X = –X – Y – 1
(C) X = –X + Y + 1 (D) = X – Y – 1
Answer: A

49. What is the probability of choosing correctly an unknown integer between 0 and 9 with 3 chances?
(A) 963/1000 (B) 973/1000
(C) 983/1000 (D) 953/1000
Answer: A

1. Any integer composed of 3^n identical digits divisible by
(A) 2^n (B) 3^n
(C) 5^n (D) 7^n
Answer: B

2. The circumferences of the two concentric disks are divided into 100 sections each. For the outer disk, 100 of the sections are painted red and 100 of the sections are painted blue. For the inner disk, the sections are painted red and blue in an arbitrary manner. It is possible to align the two disks so that …… of the sections on the inner disks have their colours matched with the corresponding section on outer disk.
(A) 100 or more (B) 125 or more
(C) 150 or more (D) 175 or more
Answer: A

1. The number of integers between 1 and 250 that are divisible by 2, 5 and 7 is
(A) 2
(B) 3
(C) 5
(D) 8
Answer: B

5. Consider the problem of connecting 19 lamps to a single electric outlet by using extension cords each of which has four outlets. The number of extension cords required is
(A) 4
(B) 5
(C) 6
(D) 7
Answer: C

1. "x^1 is a clone of x" means x^1 is identical to x in terms of the physical attributes namely, height, weight and complexion. Given, height, weight and complexion only form a complete set of attributes for an entity, cloning is an equivalence relation. What is your impression about this statement?
(A) The statement is true
(B) The statement is false
(C) The truth value of the statement cannot be computed
(D) None of these
Answer: A

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2. 'R is a robot of M' means R can perform some of the tasks that otherwise M would do and R is unable to do anything else. Which of the following is the most appropriate representation to model this situation?

(A) 

(B) 

(C) 

(D) None of these

Answer:

5. For your ATM debit card, you have a 4-decimal-digit personal secret code. In the absence of any clue, a brute-force attack takes time-'t' to crack the code on an ATM terminal. Therefore 't' is the secure-time for a customer to report in case the card is misplaced. Your Bank has decided to facilitate an increased secure-time. Out of the following, which option should provide the largest rise in the value of 't' ?
(A) Instead of 4-decimal-digits, maintain the personal secret code in 4-hexadecimal-digits.
(B) Instead of 4-decimal digits, maintain a 5-decimal-digit personal secret code.
(C) Reduce the processing speed of the ATM terminals to the half of their current speed.
(D) None of the above provides any improvement.
Answer: B

1. If she is my friend and you are her friend, then we are friends. Given this, the friend relationship in this context is ……...
(i) commutative
(ii) transitive
(iii) implicative
(iv) equivalence
(A) (i) and (ii)
(B) (iii)
(C) (i), (ii), (iii) and (iv)
(D) None of these
Answer: D

3. If in an error detection and correction code a message M : "You are good students" is stored as M' : Youare areyou aregood goodare goodstudents studentsgood. What is the space required to store M' in general? (assume that 'n' is the length of M)
(A) 2n
(B) 3n
(C) 4n
(D) less than 4n
Answer: D

1. If x and y are independent Gaussian random variables with average value 0 and with same variance, their joint probability density function is given by:

(A) p(x,y)=p(x).p(y)
(B) p(x,y)=p(x)+p(y)
(C) p(x,y)=p(x+y)
(D) p(x,y)=p(x).p(y)+p(x)
Answer:

1. A box contains six red balls and four green balls. Four balls are selected at random from the box. What is the probability that two of the selected balls are red and two are green?

(A) 3/7 (B) 4/7
(C) 5/7 (D) 6/7
Answer: A
Explanation:

$C(6,2)C(4,2)/C(10,4)$

4. Let *e*: B^*m*→B^*n* is a group code. The minimum distance of '*e*' is equal to:
(A) the maximum weight of a non zero code word
(B) the minimum weight of a non zero code word
(C) *m*
(D) *n*
Answer: B

5. If (a^2-b^2) is a prime number where a and b∈N, then:
(A) $a^2-b^2=3$ (B) $a^2-b^2=a-b$
(C) $a^2-b^2=a+b$ (D) $a^2-b^2=5$
Answer: C

5. Let A = {x | -1<x<1} = B. The function f(x)=x/2 from A to B is:
(A) injective
(B) surjective
(C) both injective and surjective
(D) neither injective nor surjective
Answer: C

Answer: B

5. Minimum number of individual shoes to be picked up from a dark room (containing 10 pair of shoes) if we have to get atleast one proper pair:
(A) 2 (B) 20
(C) 11 (D) None of these
Answer: C

1. AVA = A is called:
(A) Identity law (B) De Morgan's law
(C) Idempotent law (D) Complement law
Answer: C

31. A data cube C, has n dimensions, and each dimension has exactly p distinct values in the base cuboid. Assume that there are no concept hierarchies associated with the dimensions. What is the maximum number of cells possible in the data cube, C?
(A) p^n (B) p
(C) $(2^n-1)p+1$ (D) $(p+1)^n$
Answer: D
Explanation:
(a) What is the maximum number of cells possible in the base cuboid?
p^n.
This is the maximum number of distinct tuples that you can form with p distinct values per dimensions.
(b) What is the minimum number of cells possible in the base cuboid?
p.
You need at least p tuples to contain p distinct values per dimension. In this case no tuple shares any value on any dimension.
(c) What is the minimum number of cells possible in the data cube, C?
$(2^n-1)\times p+1$.

The minimum number of cells is when each cuboid contains only p cells, except for the apex, which contains a single cell.

(d) What is the maximum number of cells possible (including both base cells and aggregate cells) in the data cube, C?

$(p+1)^n$.

The argument is similar to that of part (a), but now we have p+1 because in addition to the p distinct values of each dimension we can also choose $*$.

32. Suppose that from given statistics, it is known that meningitis causes stiff neck 50% of the time, that the proportion of persons having meningitis is 1/50000, and that the proportion of people having stiff neck is 1/20. Then the percentage of people who had meningitis and complain about stiff neck is:

(A) 0.01% (B) 0.02%

(C) 0.04% (D) 0.05%

Answer: B

Explanation:

The computation is based on the simplified Bayes' formula.

P{B|A} = (P{A|B}·P{B) / P{A}.

P{M|S} = probability that a person had meningitis, conditioned by the existence of stiff neck.

P{S|M} = probability that a person complains about stiff neck, conditioned by the existence of meningitis. = 50%=1/2

P{S} = proportion of people who complain about stiff neck. = 1/20

P{M} = proportion of people who had meningitis. = 1/50,000

Then:

$P\{M|S\} = (P\{S|M\}\cdot P\{M\}) / P\{S\} = (1/2 \times 1/50{,}000) / 1/20 = 0.0002 = 0.02\%$

20. The no. of ways to distribute n distinguishable objects into k distinguishable boxes, so that n_i objects are placed into box i, i = 1, 2, …. k equals which of the following?

(A) $\dfrac{n!}{n_1! + n_2! + \ldots\ldots + n_k!}$

(B) $\dfrac{n_1! + n_2! + \ldots\ldots + n_k!}{n_1!\ n_2!\ n_3! \ldots\ldots n_k!}$

(C) $\dfrac{n!}{n_1!\ n_2!\ n_3! \ldots\ldots n_k!}$

(D) $\dfrac{n_1!\ n_2! \ldots\ldots n_k!}{n_1! - n_2! - n_3! \ldots\ldots - n_k!}$

Answer: C

Theorem:

The number of ways to distribute n distinguishable objects into k distinguishable boxes such that n_i objects are placed into box i, i = 1, 2, . . . , k, equals

25. The number of distinct bracelets of five beads made up of red, blue, and green beads (two bracelets are indistinguishable if the rotation of one yield another) is,

(A) 243

(B) 81

(C) 51

(D) 47

Answer: C