Q.1 The straight lines l_1, l_2 & l_3 are parallel & lie in the same plane. A total of m points are taken on the line l_1, n points on l_2 & k points on l_3. How many maximum number of triangles are there whose vertices are at these points ?

Q.2 How many five digits numbers divisible by 3 can be formed using the digits 0, 1, 2, 3, 4, 7 and 8 if each digit is to be used atmost once.

Q.3 There are 2 women participating in a chess tournament. Every participant played 2 games with the other participants. The number of games that the men played between themselves exceeded by 66 as compared to the number of games that the men played with the women. Find the number of participants & the total numbers of games played in the tournament.

Q.4 All the 7 digit numbers containing each of the digits 1, 2, 3, 4, 5, 6, 7 exactly once, and not divisible by 5 are arranged in the increasing order. Find the $(2004)^{th}$ number in this list.

Q.5 5 boys & 4 girls sit in a straight line. Find the number of ways in which they can be seated if 2 girls are together & the other 2 are also together but separate from the first 2.

Q.6 A crew of an eight oar boat has to be chosen out of 11 men five of whom can row on stroke side only, four on the bow side only, and the remaining two on either side. How many different selections can be made?

(CERT) Q.7 An examination paper consists of 12 questions divided into parts A & B.
Part-A contains 7 questions & Part–B contains 5 questions. A candidate is required to attempt 8 questions selecting atleast 3 from each part. In how many maximum ways can the candidate select the questions ?

Q.8 In how many ways can a team of 6 horses be selected out of a stud of 16, so that there shall always be 3 out of A B C A′ B′ C′ (NAMED), but never A A′, B B′ or C C′ together.

Q.9 During a draw of lottery, tickets bearing numbers 1, 2, 3,....., 40, 6 tickets are drawn out & then arranged in the descending order of their numbers. In how many ways, it is possible to have 4^{th} ticket bearing number 25.

Q.10 Find the number of distinct natural numbers upto a maximum of 4 digits and divisible by 5, which can be formed with the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 each digit not occuring more than once in each number.

Q.11 The Indian cricket team with eleven players, the team manager, the physiotherapist and two umpires are to travel from the hotel where they are staying to the stadium where the test match is to be played. Four of them residing in the same town own cars, each a four seater which they will drive themselves. The bus which was to pick them up failed to arrive in time after leaving the opposite team at the stadium. In how many ways can they be seated in the cars ? In how many ways can they travel by these cars so as to reach in time, if the seating arrangement in each car is immaterial and all the cars reach the stadium by the same route.

Q.12 There are n straight lines in a plane, no 2 of which parallel, & no 3 pass through the same point. Their point of intersection are joined. Show that the number of fresh lines thus introduced is $\frac{n(n-1)(n-2)(n-3)}{8}$.

Q.13 In how many ways can you divide a pack of 52 cards equally among 4 players. In how many ways the cards can be divided in 4 sets, 3 of them having 17 cards each & the 4^{th} with 1 card.

Q.14 A firm of Chartered Accountants in Bombay has to send 10 clerks to 5 different companies, two clerks in each. Two of the companies are in Bombay and the others are outside. Two of the clerks prefer to work in Bombay while three others prefer to work outside. In how many ways can the assignment be made if the preferences are to be satisfied.

Q.15 A train going from Cambridge to London stops at nine intermediate stations. 6 persons enter the train during the journey with 6 different tickets of the same class. How many different sets of ticket may they have had?

Q.16 Prove that if each of m points in one straight line be joined to each of n in another by straight lines terminated by the points, then excluding the given points, the lines will intersect $\frac{1}{4}mn(m-1)(n-1)$ times.

Q.17 How many arrangements each consisting of 2 vowels & 2 consonants can be made out of the letters of the word **'DEVASTATION'**?

Q.18 Find the number of words each consisting of 3 consonants & 3 vowels that can be formed from the letters of the word **"Circumference"**. In how many of these c's will be together.

Q.19 There are 5 white , 4 yellow , 3 green , 2 blue & 1 red ball. The balls are all identical except for colour. These are to be arranged in a line in 5 places. Find the number of distinct arrangements.

Q.20 How many 4 digit numbers are there which contains not more than 2 different digits?

Q.21 In how many ways 8 persons can be seated on a round table
(a) If two of them (say A and B) must not sit in adjacent seats.
(b) If 4 of the persons are men and 4 ladies and if no two men are to be in adjacent seats.
(c) If 8 persons constitute 4 married couples and if no husband and wife, as well as no two men, are to be in adjacent seats?

Q.22 (i) If 'n' things are arranged in circular order , then show that the number of ways of selecting four of the things no two of which are consecutive is

$$\frac{n(n-5)(n-6)(n-7)}{4!}$$

(ii) If the 'n' things are arranged in a row, then show that the number of such sets of four is

$$\frac{(n-3)(n-4)(n-5)(n-6)}{4!}$$

Q.23 (a) How many divisors are there of the number x = 21600. Find also the sum of these divisors.
(b) In how many ways the number 7056 can be resolved as a product of 2 factors.
(c) Find the number of ways in which the number 300300 can be split into 2 factors which are relatively prime.

Q.24 How many ten digits whole number satisfy the following property they have 2 and 5 as digits, and there are no consecutive 2's in the number (i.e. any two 2's are separated by at least one 5).

Q.25 How many different ways can 15 Candy bars be distributed between Ram, Shyam, Ghanshyam and Balram, if Ram can not have more than 5 candy bars and Shyam must have at least two. Assume all Candy bars to be alike.

Q.26 Find the number of distinct throws which can be thrown with 'n' six faced normal dice which are indistinguishable among themselves.

Q.27 How many integers between 1000 and 9999 have exactly one pair of equal digit such as 4049 or 9902 but not 4449 or 4040?

Q.28 In a certain town the streets are arranged like the lines of a chess board. There are 6 streets running north & south and 10 running east & west. Find the number of ways in which a man can go from the north-west corner to the south-east corner covering the shortest possible distance in each case.

Q.29 (i) Prove that : ${}^{n}P_{r} = {}^{n-1}P_{r} + r.\,{}^{n-1}P_{r-1}$
(ii) If ${}^{20}C_{r+2} = {}^{20}C_{2r-3}$ find ${}^{12}C_{r}$
(iii) Find the ratio ${}^{20}C_{p}$ to ${}^{25}C_{r}$ when each of them has the greatest value possible.
(iv) Prove that ${}^{n-1}C_{3} + {}^{n-1}C_{4} > {}^{n}C_{3}$ if $n > 7$.
(v) Find r if ${}^{15}C_{3r} = {}^{15}C_{r+3}$

Q.30 There are 20 books on Algebra & Calculus in our library. Prove that the greatest number of selections each of which consists of 5 books on each topic is possible only when there are 10 books on each topic in the library.