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P_X – POWER SET OF EVEN AND ODD NUMBERS OF A NUMBER ‘ X ’

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Abstract : The **power set** is defined as the set of all subsets of the set including the set itself and the null or empty set . In this connection we have introduced the newly concept the **power set of number X** is called X-power set of X .To understand concept unit digit, we must know the concept is mainly about the unit digit of a numbers and it's repetitive and non repetitive pattern on being divided by a certain number and the X-power set does not contain null set or empty set . In this paper we have newly presented on X-Power set , Even Power numbers , Odd Power number and Prime Power numbers .

Keyword: Numbers , sets , power set , power set of number X ,X-power set , algorithm.

I. Introduction

Set theory is the branch of mathematical logic that studies sets , which can be informally described as collections of objects . Although objects of any kind can be collected into a set , set theory , as a branch of mathematics .The modern study of set theory was initiated by the German mathematicians Richard Dedekind and Georg Cantor in the 1970s . In particular , Georg Cantor is commonly considered the founder of set theory .Ferreiros , Jose (1996) " On the Relation between Georg Cantor and Richard Dedekind " [12] .The positive integers are actually part of a large group of numbers called integers .Boyer." Fundamental Steps in the Development of Numeration "[1] . Integers are all the whole numbers , both positive and negative .By whole numbers we mean numbers without fractions or decimals. 1,2,3,4…… , are positive integers and-1,-2,-3……… ,are negative integers . Here 0 is an integer which is neither positive nor negative . On an integer number line , all numbers to the right of 0 are positive integers and all numbers to the left of 0 are negative integers . Also the new concept two digit , three digit and so on the natural numbers equal to two focused by Dr.A.Sudhakaraiah , A. Madhan kumar , 2021 [11] .

Set theory is the mathematical theory of well determined collections called sets , Jech , Thomas , set theory , Springer Monographs in Mathematics 2003 [9] of objects that are called members or elements ,of the set .Pure set theory deals exclusively with set , so the only sets under consideration are those whose members are also sets . Set theory , as a separate mathematical discipline , which begins in the work of Georg Cantor . One might say that set theory was born in late 1873 , when he made the amazing discovery that the linear continuum , that is , the real line , is not countable , meaning that its points can not be counted using the natural numbers . Jonson , Philip (1972) , A History of the set Theory [8] . Set theory is one of the greatest achievements of modern mathematics .

II . Preliminaries

In this paper we have discussed sum preliminary definitions like digits , numbers , whole numbers , even numbers , even digits and odd numbers , odd digits , prime numbers , prime digits , factorial , permutations , combinations , sets , subset , power set .all these we have use our newly developed concept the X – Power set .

1. Power set :

In the set theory , the power set of a set A is define as the set of all subsets of the set A including the set itself and the null or empty set . It is denoted by P(A) . Basically , this set is the combination of all subset including null set and itself of the given set .

Formula : $P(A) = 2^n$.

2. X - Power number

Let X be a number then the X – power set contains either even or odd numbers and itself not contained empty set then the X is called X – power number or let X be any whole number , if we can define an X-Power set then X is called Power number.

For example , X = 45 , P_X = { 4 , 5 , 45 , 54 } **.**

3. X – Power set

Recently we have defined the new definition of X-Power set by Dr.A.Sudhakaraiah and A.Madhan kumar (2022), Department of Mathematics , Sri Venkateswara University Tirupati , Andhra Pradesh , India . In set theory the X-Power set of a number X is denoted by P_X which can be defined as the set P_X which consist of the numbers which can be formed by using the digits of the number X , then that set P_X is called " the number power set number X " or " X-Power set . X-Power set is also defined as X = x_1x_2 , $x_1x_2x_3$, $x_1x_2x_3x_4$,………… ,$x_1x_2x_3$…….x_n be a set of whole numbers such that X ∈W or X∈$I^+$and P_x is X-Power set consisting of all possible numbers which can be formed by using digits of a given number X is called X-Power set and repeated each digit of X the number of times while forming the numbers in P_X as the number of times that digit required in X .

For example X = 42 , P_X = { 4 , 2 , 24 , 42 } or { 2, 4 , ,24 , 42 } . Another example of X = 40 , P_X = { 0 , 4 , 40 , 04 = { 0 , 4 , 40 } , since 4 = 04 . Also X = 44 , P_X = { 4 , 4 , 44 , 44 } = { 4 , 44 } . Here 4 = 4 and 44 = 44 .

4. X is a Even power number

Let X be a positive even number then the X - Power set formed by the digits of the number X . If Such a X – Power set contains all the numbers are even numbers then X is called even power number .

For example , X = 48 is even number then the X – Power set P_x = { 4 , 8 , 48 , 84 } here all numbers of X – power set is even numbers , therefore X = 48 is a even power number . Suppose X = 34 is a even number then the X – Power set P_X = { 3 , 4 , 34 , 43 } .

Here all numbers of $P_X$are not even numbers .

Since 3 and 43 are not even so that X = 34 is not an even power number .

5. X is an Odd Power number

let X be a positive odd number then the X - Power set formed by the digits of the number X . If Such a X – Power set contains all the numbers are odd numbers then X is called an odd power number .

For example , X = 17 is an odd number then the X – Power set P_x = { 1 , 7 , 17 , 71 } here all numbers of X – power set is an 0dd numbers .Therefore X = 17 is an odd power number .

Suppose X = 21 is an odd number then the X – Power set P_X = { 2 , 1 , 12 , 21 } .Here all numbers of P_X are not odd numbers .

Since 2 and 12 are not odd numbers . So that X = 21 is not an odd power number .

6. X is a Prime power number

Let X be a positive prime number then the X – Power set formed by the digits of the number X . If such a X – Power set contains all the numbers are prime numbers then X is called prime power number.

For example , X = 37 is a prime number then the X – Power set P_x = { 3 , 7 , 37 , 73 } .

Here all numbers of X – power set is prime numbers and therefore X = 37 is a prime power number . Suppose X = 23 is a prime number then the X – Power set P_X = { 2 , 3 , 23 , 32 } .

Here all numbers of P_X is not prime numbers .

Since 32 is not a prime so that X = 23 is not a prime power number

III. Main theorems

1.Theorem *:* Let $X = x_1x_2$or y_1y_2 or z_1z_2 ……., be a positive even numbers and all the digits of X are even if and only if the numbers of the X-power set P_X are even numbers only .

Proof : Let us consider a number of $X = x_1x_2$,be a positive even number and suppose x_1x_2 is a two digit even number or y_1y_2 is a two digit even number and also z_1z_2.Now we will prove that P_X be the X-power set of X and is the all digits of X is even digits if and only if in the numbers in the X - Power set are even numbers only .

In this it will arise two conditions namely , Necessary condition and Sufficient condition .

Necessary condition : We consider the digits of the number $X = x_1x_2$ or y_1y_2 or z_1z_2 ……..,is an even number . Then we want to show that , the numbers in the X-Power set P_X of X is even numbers only . Let $x_1x_2 \in X$ be a positive even number . By the definition of the X-power set such that , $x_1 \in P_X$ and $x_2 \in P_X$ both are even digits . Since P_X is the X-Power set of $X = x_1x_2$ which means P_X is formed by the digits of the given number $X = x_1x_2$. In this connection we have already considered $X = x_1x_2$ is a positive even number and also considered the digits of the number $X = x_1x_2$ is even number . So ,All the numbers formed by the digits x_1 , x_2 ,x_1x_2 ,x_2x_1 $\in P_X$ of the number $X = x_1x_2$ are even numbers only . Therefore , by definition the number formed by even digits are even numbers only .

Sufficient condition : Let x_1 , x_2 ,x_1x_2 ,$x_2x_1 \in P_X$ be a X-Power set of X . Our aim to show that the digits of $X = x_1x_2$ is an even number and also x_1 and x_2 are even digits .Let the numbers in the P_X are even such that x_1 , x_2 ,x_1x_2 ,x_2x_1 are even numbers .Which implies that , we get P_X is X- Power set .Since $X \in P_X$ and therefore X is an even number .

Suppose , if all the digits of the number $X = x_1x_2$ are not even then it not possible to get all even number in P_X . Since $X = x_1x_2$ even number , $X = x_1x_2$ and x_1 , x_2 are even .

1.1.Illustration :

Let us consider $X = x_1x_2 = 42$ where $x_1 = 4$ and $x_2 = 2$ are both evenP_{42} be the 42-Power set P_{42} ={ 2 , 4 , 24 , 42 } . Here 2 , 4 , 24 , 42 are even numbers .

An another example $X = x_1x_2 = 54$ even number but here $x_1 = 5$ and $x_2 = 4$ are not both even . Since P_{54} be the 54-Power set . P_{54} ={ 5 , 4 , 54 , 45 } . Here 5 , 4 , 54 , 45 all numbers are not even .

1.2.To find P_X is even X- power set with algorithm :

Let us consider any even number $X = x_1x_2$ or y_1y_2 or z_1z_2 …… , .

Input : $X = x_1x_2$ an even number

Out put : P_X is an even X- power set

Step 1 : $X = x_1x_2$ an even number

Step 2 : Store x_1 , x_2

Step 3 : check x_1 , x_2 are even . go to step 4 , otherwise go to step 8

Step 4 : store x_1 , x_2 , x_1x_2 , x_2x_1 in P_X set which are formed by x_1 , x_2

Step 5 : check P_X has distinct numbers go to step 7 , otherwise step 6

Step 6 : Remove same or repeated numbers in P_X and we should take the numbers only one time in P_X or X-power .

Step 7 : check all numbers are even in $P_X$go to step 9 , otherwise go to step 8

Step 8 : Check the number X is an even or not

Step 9 : P_X is an even X- power set .

1.3.Algorithm with illustration :

Input : X = x_1x_2 = 48 is aneven number

Out put : P_X is an even X-power set = { 4 , 8 , 48 , 84 }

Step 1 : X = x_1x_2 = 48 aneven number

Step 2 : Store $x_1 = 4$, $x_2 = 8$

Step 3 : 4 , 8 are even numbers

Step 4 : P_X = { 4 , 8 , 48 , 84 }

Step 5 : P_X has distinct numbers

Step 6 : 4 , 8 , 48 , 84 are even numbers

Step 7 : P_X is an even X-power set.

2.Theorem *:* Let X = $x_1x_2$or $x_1x_2x_3x_2$ or $x_1x_2x_3x_4$ or $x_1x_2x_3x_4x_5$.......x_n, be a positive even numbers and all the digits of X are even if and only if the numbers of the X-power set P_X are even numbers only .

Proof : The proof as follows theorem 3.1 .

2.1.Illustration :

We consider X = 464 or X = 2486 or X = 2222 and so on all are even numbers as will as even digits . Let us take X = 484 be a positive even number . Here 4,8 are even digits .

P_{484} = { 4 , 8 , 48 , 44 , 84 , 448 , 484 , 844 }. Here all 4 , 8 , 48 , 44 , 84 , 448 , 484 , 844 numbers in P_{484} are even .

2.2Conversely with illustration :

Let us take the number X = 2322 is even number but 3 is not even digit of X . P_{2322} ={ 2 , 3 , 22 , 23 , 32 , 223 , 232 , 322 , 2223 , 2232 , 2322 , 3222 } . Here 3 , 223 , 2223 are not even numbers so that P_{2322} is not even X-power set.

3.Theorem *:* Let X = $x_1x_2$or y_1y_2 or z_1z_2 ...., be the positive odd numbers and all the digits of X are odd if and only the numbers of the X - Power set $P_X$are odd numbers only .

Proof : We consider for any two digit odd number X where X = $x_1x_2$or y_1y_2 or z_1z_2 ....,be the positive odd numbers such that $x_1x_2 \in I^+$ and also x_1 , $x_2 \in I^+$.

We will prove that P_X be the X-power set of X and all digits of X is odd digits if and only if in the numbers in the X - Power set P_X are odd numbers only .

We will prove the theorem by the Necessary and Sufficient conditions .

Necessary condition : If all the digits of the number X = x_1x_2 is odd digits .Then ,We want to show that , the numbers in the X-Power set P_X of X is odd numbers only .

Since , $x_1 \in P_X$ and $x_2 \in P_X$ both are odd digits . P_X is the X-Power set of X = x_1x_2 which means P_X is formed by the digits of the given number X = x_1x_2. In this connection we have already considered X = x_1x_2 is a positive odd number and also considered the digits of the number X = x_1x_2 is odd number. So ,All the numbers formed by the digits x_1 , x_2 ,x_1x_2 ,x_2x_1 $\in P_X$ of the number X = x_1x_2 are odd numbers only . Therefore , the number formed by odd digits are odd numbers only.

Sufficient condition : Let x_1 , x_2 ,x_1x_2 ,x_2x_1 $\in P_X$ be a X-Power set of X .

Our aim to show that , the digits of $X = x_1x_2$ is odd number and also x_1 and x_2 are odd digits .Let the numbers in the P_X are odd this means that x_1 , x_2 ,x_1x_2 ,x_2x_1 are odd numbers .Which implies that , we get P_X is X- Power set , $X \in P_X$ therefore X is an odd number.

Suppose ,If all the digits of the number $X = x_1x_2$ are not odd then it not possible to get all odd number in P_X . Since $X = x_1x_2$ odd number , $X = x_1x_2$ and therefore x_1 , x_2 are odd .

3.1. Illustration :

Let us consider $X = x_1x_2 = 53$, Where $x_1 = 5$ and $x_2 = 3$ are both odd

P_{53} be the 53-Power set that is P_{53} ={ 5 , 3 , 35 , 53 } . Here 5 , 3 , 35 , 53 are odd numbers .

An another example $X = x_1x_2 = 45$ odd number . But here $x_1 = 4$ and $x_2 = 5$, both are not odd.

P_{45} be the 45-Power set P_{45} = { 4 , 5 , 45 , 54 } .Here 4 , 5 , 45 , 54 all are not odd numbers.

3.2.To find P_X is an odd power set with Algorithm :

Input : $X = x_1x_2$ an odd number

Out put : P_X is an odd power set

Step 1 : $X = x_1x_2$ an odd number

Step 2 : Store x_1 , x_2

Step 3 : check x_1 , x_2 are odd . go to step 4 , otherwise go to step 8

Step 4 : store x_1 , x_2 , x_1x_2 , x_2x_1 in P_X set which are formed by x_1 , x_2

Step 5 : check P_X has distinct numbers go to step 7 , otherwise step 6

Step 6 : Remove same or repeated numbers and take one time only in P_X

Step 7 : check all numbers are odd number go to step 9 , otherwise go to step 8

Step 8 : Check the number X is an odd or not

Step 9 : P_X is odd power set .

3.3.Algorithm with example

Input : $X = x_1x_2 = 35$odd number

Out put : P_X is odd power set

Step 1 : $X = x_1x_2 = 35$ odd number

Step 2 : Store $x_1 = 3$, $x_2 = 5$

Step 3 : 3, 5 are odd numbers

Step 4 : P_X = { 3 , 5 , 35 , 53 }

Step 5 : P_X has distinct numbers

Step 6 : 3 , 5 , 35 , 53 are both odd numbers

Step 8 : P_X is 0dd power set .

4.Theorem : Let X = $x_1x_2$or $x_1x_2x_3x_2$ or $x_1x_2x_3x_4$ or $x_1x_2x_3x_4x_5$…….x_n, be a positive odd numbers and all the digits of X are odd if and only if the numbers of the X-power set P_X are odd numbers only .

Proof : The proof as follows theorem 3.3.

4.1.Illustration :

We consider X = 357 or X = 7537 or X = 77557 and so on all are odd numbers as will as odd digits . Let us X = 335 be a positive odd number . Here 3 , 5 are odd digits .

P_{335} = { 3 , 5 , 33 , 35 , 53 , 335 , 353 , 533 } .

Here all 3 , 5 , 33 , 35 , 53 , 335 , 353 , 533 numbers in P_{335} are odd .

Conversely with illustration :

Let us take the number X = 3233 is odd number but 2 is not odd digit of X .

P_{3233} ={ 2 , 3 , 33 , 23 , 32 , 233 , 332 , 323 , 333 , 2333 , 3323 , 3233 , 2333 , 3332 } .

In this we have observed that 2 , 32 are not odd numbers so that P_{3233} is not odd X-power set.

III.Conclusion

In this paper we discussed the P_x – power set of even and odd numbers of a number X and using different numbers of X which are even and odd numbers. In this paper we have newly focused about the X-power set . And also we are going to find newly concept about the order of X-power set of X with all positive integers .

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