Salahaddin Unersity-Erbil

On para b-*open sets*

Research Project

Submitted to the department of (mathematic) in partial fulfilment of the Requirements for the degree of BSc. In mathematic

By:

Aisha Anwar Omer

Supervised by:

Assist.Prof.Dr.Nehmat K. Ahmed

April-2024

Acknowledgment

I would like to thanks Allah for ging me the power to complete this work. And I would like to present my profound thanks to supervisor and lecturer **Assist. Prof. Dr. Nehmat K. Ahmed** for his kind valuable suggestions that assisted me to accomplish this work. I would also like to extend my gratitude to the head of mathematic department **Assist. Prof. Dr. Rashad Rashid Haji,** and especially thanks for my family to support me and make me what am I today, and thanks all my friends

Abstract

In this report we have a set which contain three and four elements X={a,b,c) And x={a,b,c,d}. The set which containing 3 element has 9 non comparable topology and the set which contains four element has 33 non comparable topology and we try to obtain the b-*open sets* to each such topology.

Table of Contents

Introduction

General Topology or Point Set Topology.

A new class of nearly open sets in a topological space, called b-open sets, is introduced and studied. This class is contained in the class of semi-preopen sets and contains each of semi-open sets and preopen sets. It is proved that the class of b-open sets generates the supra topology as the class of supra b-open sets.

B-Open set introduced by Andrijevic in 1996. A subset A of topological space (X, π),is said to be b-open set if $A \subseteq clintA \cup intclA$. The set of all b-open denoted by bo(x).

Chapter one

Definition1.1:Topology((KURONYA January 24, 2010)

A topological space is ordered pair (X,π),where X is a set, π a collection of subsets of X satisfying the following properties

1) $\emptyset$, X ∈ π,

2) U, V ∈ π implies $U \cap V \in \pi$

3) $\{U_\alpha | \propto \in I\} \in \pi$ implies $U_{\propto \in I}\, U_\propto \in \pi$.

The collection π is called topology on X, the pair (X, π) a topological space, the elements of π are called open sets.

Definition1.2: bo-open set.

Let (X,π), be a topological spaces subset A of X is said to be bo-open set if $A \subseteq clintA \cup intclA$.

Definition1.3: interior

Let (X,π), be a topological spaces subset A of X, Int A is the largest open set contained in A.

Definition1.4: closure

Let (X,π), be a topological spaces subset A of X, Cl A is the smallest closed set containing A.

Definition1.4: A proper non–empty b − open subset U at a topological space X is said to be minimal b − open set if any b– open set which is contained in U is ϕ or U, The family of all minimal b- open sets in a topological space X is denoted by Mibo(x).

Definition1.5: A proper non–empty b − open set U of a topological space X is said to be maximal b– open set if any b– open set which contains U is X or U. The family of all maximal b- open sets in a topological space X is denoted by Mabo(x)

Chapter Two

The topologies which define on the set X= {a,b,c }which are different in element and property

$\pi_1=\{\emptyset, X\}$

$\pi_2=\{\emptyset, X, \{a\}\}$

$\pi_3=\{\emptyset, X, \{a, b\}\}$

$\pi_4=\{\emptyset, X, \{a\}, \{b, c\}\}$

$\pi_5=\{\emptyset, X, \{a\}, \{a, b\}\}$

$\pi_6=\{\emptyset, X, \{a\}, \{b\}, \{a, b\}\}$

$\pi_7=\{\emptyset, X, \{a\}, \{a, b\}, \{a, c\}\}$

$\pi_8=\{\emptyset, X, \{a\}, \{b\}, \{a, b\}, \{b, c\}\}$

$\pi_9=\{\emptyset, X, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

π_1={Ø,X}

$\pi^C = \{X, Ø\}$

bo(x)= $\{Ø, X, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

Minbo(x) = {Ø,{a},{b},{c}}

Maxbo(X) = {X,$\{a, b\}, \{a, c\}, \{b, c\}\}$

$\pi 2 = \{Ø, X, \{a\}\}$

$\pi^C = \{X, Ø, \{b, c\}\}$

bo (X) = $\{X, Ø, \{a\}$, {b},$\{a, b\}, \{a, c\}\}$

Minbo(X) = { Ø, { a},{b}}

Maxbo(X) = {X, {a,b},{ a,c}}

π_3=$\{Ø, X, \{a, b\}\}$

$\pi^C = \{X, Ø, \{c\}\}$

bo(X) = $\{Ø, X, \{a\}, \{b\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

Minbo(X) = { Ø,{ a},{b }}

Maxbo(X) = {X,{ a,b}{ a,c},{b,c}}

$\pi_4 = \{\emptyset, X, \{a\}, \{b, c\}\}$

$\pi^C = \{X, \emptyset, \{b, c\}, \{a\}\}$

bo(x)= $\{\emptyset, X, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

Minbo(X) = $\{\emptyset, \{a\}, \{b\}, \{c\}\}$

Maxbo(X) = $\{X, \{a, b\}, \{a, c\}, \{b, \text{c}\}\}$

$\pi_5 = \{\emptyset, X, \{a\}, \{a, b\}\}$

$\pi^C = \{X, \emptyset, \{b, c\}, \{c\}\}$

bo(x)= { ϕ , X , {a} , {a , b} , {a , c} }

Minbo(X) = $\{\emptyset, \{a\}\}$

Maxbo(X) =$\{X, \{a, \text{b}\}, \{a, \text{c}\}\}$

$\pi_6 = \{\emptyset, \text{X}, \{a\}, \{b\}, \{a, b\}\}$

$\pi^C = \{X, \emptyset, \{b, c\}, \{a, c\}\}, \{c\}\}$

bo(X) =$\{\emptyset, X, \{a\}, \{b\}, \{\text{c}\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

Minbo(X) = $\{\emptyset, \{a\}, \{b\}, \{\text{c}\}\}$

Maxbo(X) = $\{X, \{a, b\}, \{a, c\}\{b, c\}, \{b, c\}\}$

$\pi 7=\{\emptyset, X, \{a\}, \{a, b\}, \{a, c\}\}$

$\pi^C = \{X, \emptyset, \{b\}, \{c\}, \{b, c\}\}$

bo(X) =$\{\emptyset, X, \{a\}, \{b\}$,{c}, $\{a, b\}, \{a, c\}, \{b, c\}\}$

Minbo(X) = $\{\emptyset, \{a\}, \{b\}$,{c}}

Maxbo(X) = $\{ X, \{a, b\}, \{a, c\}\{b, c\}$,$\{b, c\}$

$\pi 8=\{\emptyset, X, \{a\}$,$\{b\}, \{a, b\}, \{b, c\}\}$

$\pi^C = \{X, \emptyset, \{b, c\}, \{a, c\}, \{c\}$,$\{a\}\}$

bo(X)={ Ø,X,{ a},{b},{a, b}, { a,c},{b,c}}

Minbo(X) = {Ø,{a}, {b}}

Maxbo(X) = {X,{a, b}, {a, c},{b,c}}

$\pi 9=\{\emptyset, X$,{ $a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

π^C =$\{\emptyset, X, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

bo(X) =$\{\emptyset, X, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}\}$

Minbo(X) =$\{\emptyset, \{a\}, \{b\}, \{c,\} \}$

Maxbo(X) =$\{X, \{a, b\}, \{a, c\}, \{b, c\}\}$

The topologies which define on the set X= {a,b,c,d}which are different in element and property

$\pi_1=\{\emptyset, X\}$

$\pi_2 = \{\emptyset, X, \{a\}\}$

$\pi_3=\{\emptyset, X, \{a, b\}\}$

$\pi_4=\{\emptyset, X, \{a, b, c\}\}$

$\pi_5 = \{\emptyset, X, \{a\}, \{b, c, d\}\}$

$\pi_6=\{\emptyset, X, \{a, b\}, \{c, d\}\}$

$\pi_7=\{\emptyset, X, \{a\}, \{a, b\}\}$

$\pi 8=\{\emptyset, X, \{a\}, \{a, b, c\}\}$

$\pi 9=\{\emptyset, X, \{a, b\}, \{a, b, c\}\}$

$\pi 10=\{\emptyset, X, \{a\}, \{a, b\}, \{a, b, c\}\}$

$\pi 11=\{\emptyset, X, \{a, b\}, \{a, b, c\}, \{a, b, d\}\}$

$\pi 12=\{\emptyset, X, \{a\}, \{b\}, \{a, b\}\}$

$\pi 13=\{\emptyset, X, \{a\}, \{b, c\}, \{a, b, c\}\}$

$\pi 14=\{\emptyset, X, \{a\}, \{a, b\}, \{a, c, d\}\}$

$\pi 15=\{\emptyset, X, \{a\}, \{a, b\}, \{a, c\}, \{a, b, c\}\}$

$\pi 16=\{\emptyset, X, \{a\}, \{a, b\}, \{a, b, c\}, \{a, b, d\}\}$

$\pi 17=\{\emptyset, X, \{a\}, \{b\}, \{a, b\}, \{a, b, c\}\}$

π_{18}={Ø, X, {a}, {b}, {a, b}, {a, c, d}}

π_{19}={Ø, X, {c}, {a, b}, {a, b, c}, {a, b, d}}

π_{20}={Ø, X, {a}, {a, b}, {c, d}, {a, c, d}}

π_{21}={Ø, X, {a}, {a, b}, {a, c}, {a, b, c}, {a, b, d}}

π_{22}={Ø, X, {a}, {b}, {a, b}, {b, c}, {a, b, c}}

π_{23}={Ø, X, {a}, {b}, {a, b}, {a, b, c}, {a, b, d}}

π_{24}={Ø, X, {a}, {b}, {a, b}, {c, d}, {a, c, d}, {b, c, d}}

π_{25}={Ø, X, {a}, {b}, {a, b}, {b, d}, {a, b, c}, {a, b, d}}

π_{26}={Ø, X, {a}, {b}, {a, b}, {a, c}, {a, b, c}, {a, c, d}}

π_{27}={Ø, X, {a}, {a, b}, {a, c}, {a, d}, {a, b, c}, {a, b, d}, {a, c, d}}

π_{28}={Ø, X, {a}, {b}, {c}, {a, b}, {b, c}, {a, b, c}}

π_{29}={Ø, X, {a}, {b}, {a, b}, {a, c}, {b, d}, {a, b, c}, {a, b, d}}

π_{30}={Ø, X, {a}, {b}, {c}, {a, b}, {a, c}, {b, c}, {a, b, c}, {a, b, d}}

π_{31}={Ø, X, {a}, {b}, {a, b}, {a, c}, {a, d}, {a, b, c}, {a, b, d}, {a, c, d}}

π_{32}={Ø, X, {a}, {b}, {c}, {a, b}, {a, c}, {a, d}, {b, c}, {a, b, c},

{a, b, d}, {a, c, d}}

π_{33}={Ø, X, {a}, {b}, {c}, {d}, {a, b}, {a, c}, {a, d}, {b, c}, {b, d}, {c, d},

{a, b, c}, {a, b, d}, {a, c, d}, {b, c, d}

π_1={Ø,X}

$\pi^C = \{X, Ø\}$

bo(X) = P(X)

Minbo(X) = {Ø, {a}, {b}, {c},{d}}

Maxbo(X) = {X,{a, b, c}, {a, b, d}, {a, c, d},{c,b,d}}

Parbo(x)={{a, b}, {a, c}, {a, d},{b,c},{b,d},{c,d}}

$\pi 2 = \{Ø, X, \{a\}\}$

$\pi^C = \{X, Ø, \{b, c$,d}

bo(X) = { Ø, X, {a}, {a, b}, {a, c},{a, d},{a, b, c},{a, b, d},{a, c, d}}

Minbo(X)={Ø,{a}}

Maxbo(X) = {X, {a, c, d},{a, b, d },{a, c, d}}

Parbo(X)= {{a, b},{a, c},{a, d}}

π_3={Ø, X, {a, b}}

$\pi^C = \{X, Ø,$ {c,d}}

bo(X) = P(x)\[{c},{d},{c,d}]

Minbo(X) = {Ø, { a},{b}}

Mxabo(X) = { X,{a, b, c }, {a, b, d},{a,c,d}}

Parbo(x)={{a,b},{a,c},{a,d},{b,c}

π_4={$\emptyset, X, \{a, b, c\}$}

$\pi^C = \{X, \emptyset$,{d}}

bo(X) = p(x)\[{d}]

Minbo(X) = {$\emptyset$,{ a},{ b},{ c}}

Maxbo(X) = {X,{ a, b, c },{a, b, d}, {a, c, d}}

Parbo(x)= $\{\{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}, \{c, d\}\}$

$\pi 5 = \{\emptyset, X, \{a\}, \{b, c, d\}$

π^C ={ $X, \emptyset$,{b, c, d},{a}}

bo(x)=P(x)

Minbo(X) = {$\emptyset$, {a}, {b},{ c},{ d}}

Maxbo(X) = {X, {a,b,c}, {a, b, d},{a, c, d},{a, b, d}}

Parbo(x)={{ a, b}, {a, c}, {a, d},{b, c}, {b, d}, {c, d}}`

$\pi 6$={$\emptyset, X, \{a, b\}$, {c, d}}

$\pi^C = \{X, \emptyset$, {c, d}, {a, b}

bo(X) = P(x)

Minbo(X) = {$\emptyset$, {a},{ b},{c}, {d}}

Maxbo(X) = { $X, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}, \{b, c, d\}$ }

Parbo(x)= $\{\{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}, \{c, d\}\}$

$\pi_7=\{\emptyset, X, \{a\}, \{a, b\}\}$

$\pi^C = \{X, \emptyset, \{b, c, d\}, \{c, d\}\}$

$bo(X) = \{ \emptyset, X, \{a\}, \{a, b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

$Minbo(X)=\{\emptyset, \{a\}\}$

$Maxbo(X) = \{X, \{a, c, d\}, \{a, b, d\}, \{a, c, d\}\}$

$Parbo(X)= \{\{a, b\}, \{a, c\}, \{a, d\}\}$

$\pi 8=\{\emptyset, X, \{a\}, \{a, b, c\}\}$

$\pi^C = \{X, \emptyset, \{b, c, d\}, \{d\}$

$bo(X) = \{\emptyset, X, \{a\}, \{a, b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

$Minbo(X) = \{\emptyset, \{ a\}\}$

$Maxbo(X) = \{X, \{a, b, c\}, \{a, b, d\}, \{a, b, d\}\}$

$Parbo(X)=\{\{a, b\}, \{a, c\}, \{a, d\}\}$

$\pi_9=\{\emptyset, X, \{a, b\}, \{a, b, c\}\}$

$\pi^C = \{X, \emptyset, \{ , d\}, \{d\}$

$bo(X) = P(x)\backslash[\{c\}, \{d\}, \{c, d\}]$

$Minbo(X) = \{\emptyset, \{ a\}, \{b\}\}$

$Maxbo(X) = \{ X, \{a, b, c \}, \{a, b, d\}, \{a, c, d\}\}$

$Parbo(x)=\{\{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}$

$\pi 10$={Ø, X, {a}, {a, b}, {a, b, c}}

$\pi^C = \{X, Ø, \{b, c$,d}, {c,d}, {d}

bo(X) = {Ø, X, {a}, {a, b}, {a, c}, {a, d}, {a, b, c}, {a, b, d}, {a, c, d}}

Minbo(X) ={ Ø,{a}}

Maxbo(X) ={X,{a, b, c},{a, b, d},{a, c, d}}

Parbo(X)={{a, b},{a, c},{a, d}}

$\pi 11$={Ø, X, {a, b}, {a, b, c}, {a, b, d}}

π^C = {X, Ø, {c,d}, {d}, {c}}

bo(X) = P(x)\[{c},{d},{c,d}]

Minbo(X) = {Ø, { a,b}}

Maxbo(X) = { X,{a, b, c }, {a, b, d},{a,c,d}}

Parbo(x)={{a,b},{a,c},{a,d},{b,c}

$\pi 12$={Ø, X, {a}, {b}, {a, b}}

π^C = {X, Ø, {b, c,d}, {a, c,d}, {c,d}

bo(X) = P(x)\[{c},{d},{c,d}]

Minbo(X) = {Ø, { a,b}}

Maxbo(X) = { X,{a, b, c }, {a, b, d},{a,c,d}}

Parbo(x)={{a,b},{a,c},{a,d},{b,c}

$\pi 13$={Ø, X, {a}, {b, c}, {a, b, c}}

$\pi^C = \{X, Ø, \{b, c$,d}, {a, d}, {d}}

bo(X) = P(x)\{d},{b,d},{c,d}}

Minbo(X) = {Ø, X, {a},{ c}}

Maxbo(X) = {X, {a, b,c}, {a, b, d}, {b, c, d}{c,b,d}}

Parbo(x)={ {a, b}, {a, c},{a, d}, {b, c}}

$\pi 14$={Ø, X, {a}, {a, b}, {a, c, d}}

π^C ={Ø, X, {b, c,d}, {a, c}, { b}}

bo(X) = $\{Ø, X, \{a\}, \{a, b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

Minbo(X) = $\{Ø, \{a\}\}$

Maxbo(X) = {Ø, {a, b, c }, {a, b, d}, {a, c, d}}

Parbo(X) ={{a,b}, {a, c}, {a, d}}

$\pi 15$={Ø, X, {a}, {a, b}, {a, c}, {a, b, c}}

π^C = {X, Ø, {b,c, d}, {c, d}, {b,d},{d}}

bo(X) = $\{Ø, X, \{a\}, \{a, b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

Minbo(X) = $\{Ø, \{a\}\}$

Maxbo(X) = { X, ,{a, b, c},{a, b, d},{a, c, d}}

Parbo(X)= {{a, b},{a, c},{a, d}}

$\pi 16$={Ø, X, {a}, {a, b}, {a, b, c}, {a, b, d}}

π^{C} ={ X, Ø,{b,c,d},{c,d},{d},{c}}

$\text{bo}(X) = \{Ø, X, \{a\}, \{a, b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

$\text{Minbo}(X) = \{Ø, \{a\}\}$

Maxbo(X) ={X, {a, b, c}, {a, b, d},{a, c, d}}

Parbo(x) ={{a, b},{a, b},{a ,c}}

$\pi 17$={ Ø , X, {a}, {b}, {a, b}, {a, b, c}}

π^{C} = {X, Ø,{b,c,d},{a,c,d},{c,d},{d}}

$\text{bo}(X)$ = P(x)\[{c},{d},{c,d}]

$\text{Minbo}(X)$ = {Ø, { a},{b}}

$\text{Maxbo}(X)$ = { X,{a, b, c }, {a, b, d},{a,c,d}}

Parbo(x)={{a,b},{a,c},{a,d},{b,c}

$\pi 18$={Ø, X, {a}, {b}, {a, b}, {a, c, d}}

π^{C} = {X, Ø,{b,c,d},{a,c,d},{c,d},{b}}

$\text{bo}(X) = \{Ø, X, \{a\}, \{b\}, \{a, b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

$\text{Minbo}(X)$ = {Ø, { a},{ b}}

$\text{Maxbo}(X)$ = { X, {a, b, c} ,{a, b, d} , {a, c, d}}

$\text{Parbo}(X)$ = { {a, b}, {a , b} , {a, d}}

$\pi 19$={Ø, X, {c}, {a, b}, {a, b, c}, {a, b, d}}

π^C = {X, Ø,{a,b,d},{c,d},{d},{c}}

bo(X) = {Ø, X, {c}, {a, b}, {a, b, c}, {a, b, d}}

Minbo(X) = {Ø, {c}}

Maxbo(X) = {X, {a , b, c}, {a, b, d}}

Parbo(x)= {a, b}

$\pi 20$={Ø, X, {a}, {a, b}, {c, d}, {a, c, d}}

π^C = {X, Ø,{b,c,d},{c,d},{a,b},{b}}

bo(X) = {Ø, X, {a}, {c},{d},{a,b}, {a, c}{a,d},{c,d},{a,b,c}{a,b,d}, {a, c, d}}

Minbo(X) = {Ø, {a},{c},{ d}}

Maxbo(X) = { X, {a, b,c}, {a , b, d},{a,c,d}}

Parbo(x)={{a,b}, {a, c}{a,d},{c,d}}

π_{21}={Ø, X, {a}, {a, b}, {a, c}, {a, b, c}, {a, b, d}}

π^C ={ X,Ø,{ b,c,d},{c,d},{b,d},{d},{c}}

bo(X) = { Ø, X, {a}, {a, b}, {a, c},{a, d},{a, b, c},{a, b, d},{a, c, d}}

Minbo(X)={Ø,{a}}

Maxbo(X) = {X, {a, c, d},{a, b, d },{a, c, d}}

Parbo(X)= {{a, b},{a, c},{a, d}}

π22=$\{\emptyset, X, \{a\}, \{b\}, \{a, b\}, \{b, c\}, \{a, b, c\}\}$

π^C =$\{ X,\emptyset,\{b,c,d\},\{a,c,d\},\{c,d\},\{a,d\},\{d\}\}$

$bo(X) = \{ X,\emptyset, \{a\}, \{b\}, \{a, b\}, \{a, d\}, \{b, c\}, \{b, d\}, \{a, b, c\}, \{a, b, d\}, \{b, c, d\}\}$

$Minbo(X) = \{\emptyset, \{a\}, \{b\}\}$

$Maxbo(X) = \{ X, \{a, b, c\}, \{a, b, d\}, \{b, c, d\}\}$

$Parbo(X) = \{\{a, b\}, \{a, d\}, \{b, c\}, \{b, d\}\}$

π23=$\{\emptyset, X, \{a\}, \{b\}, \{a, b\}, \{a, b, c\}, \{a, b, d\}\}$

π^C =$\{ X,\emptyset, \{b,c,d\},\{a,c,d\},\{c,d\},\{d\},\{c\}\}$

$bo(X) = P(x)\setminus[\{c\},\{d\},\{c,d\}]$

$Minbo(X) = \{\emptyset,\{ a\},\{b\}\}$

$Maxbo(X) = \{ X,\{a, b, c \}, \{a, b, d\},\{a,c,d\}\}$

Parbo(x)=$\{\{a,b\},\{a,c\},\{a,d\},\{b,c\}$

π_{24}=$\{\emptyset, X, \{a\}, \{b\}, \{a, b\}, \{c, d\}, \{a, c, d\}, \{b, c, d\}\}$

π^C =$\{ X,\emptyset, \{b,c,d\},\{a,c,d\},\{c,d\},\{a,b\},\{b\},\{a\}\}$

$bo(X) = P(x)$

$Mibo(X) = \{\emptyset, \{a\}, \{ b\} ,\{ c\}, \{d\}\}$

$Mabo(X) = \{ X, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}, \{b, c, d\}\}$

Parbo(x)= $\{\{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}, \{c, d\}$

π_{25}={Ø, X, {a}, {b}, {a, b}, {b, d}, {a, b, c}, {a, b, d}}

π^C ={ X,Ø, {b,c,d},{a,c,d},{c,d},{a,c},{d},{c}}

bo(X) = {Ø, X, {a}, {b}, {a, b}, {a, c}, {b, c}, {b, d}, {a, b, c}, {a, b, d}, {b, c, d}}

Minbo(X) = {Ø, {a}, {b}}

Maxbo(X) = { X, {a, b, c}, {b, c, d}, {a, b, d}}

Parbo(X) = {{a, b}, {a, c}, {b, c},{ b, d}}

π_{26}={Ø, X, {a}, {b}, {a, b}, {a, c}, {a, b, c}, {a, c, d}}

π^C ={ X,Ø, {b,c,d},{a,c,d},{c,d},{a,c},{d},{c}}

bo(X) = {Ø, X, {a}, {b}, {a, b}, {a, c}, {a, d}, {a, b, c}, {a, b, d}, {a, c, d}}

Minbo(X) = {Ø, {a}, {b}}

Maxbo(X) = { X, {a, b, c}, {b, c, d}, {a, b, d}}

Parbo(X) = {{a, b}, {a, c}, {a, d}}

π_{27}={Ø, X, {a}, {a, b}, {a, c}, {a, d}, {a, b, c}, {a, b, d}, {a, c, d}}

π^C ={ X,Ø,{b,c,d},{c,d},{b,d},{b,c},{d},{c},{b}}

bo(X) = {Ø, X, {a}, { b}, {a, c}, {a, d}, {a, b, c}, {a, b, d}, {a, c, d}}

Minbo(X) = {Ø, {a},{ b}}

Maxbo(X) = {X, {a, b, c}, {a,b,d}, {a, c, d}}

Parbo(X) = {{a, b}, {a, c}, {a, d}}

π_{28}=$\{\emptyset, X$, {a}, $\{b\}, \{c\}$, {a, b}, {b, c}, {a, b, c}}

π^C ={ X,Ø, $\{b, c, d\}$,$\{a, c, d\}$,$\{a, b, d\}$,$\{c, d\}$,$\{a, d\}$,$\{d\}$}

bo(X) = p(x)\[{d}]

Minbo(X) = {Ø,{ a},{ b},{ c}}

Maxbo(X) = {X,{ a, b, c },{a, b, d}, {a, c, d}}

Parbo(x)= $\{\{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}, \{c, d\}\}$

π_{29}=$\{\emptyset, X$, {a}, $\{b\}$, {a, b}, {a, c}, {b, d}, {a, b, c}, {a, b, d}}

π^C ={ X,Ø, $\{b, c, d\}$,$\{a, c, d\}$,$\{b, c\}$,$\{b, d\}$,$\{a, c\}\{d\}$,$\{c\}$,

bo(X) = $\{\emptyset, X, \{a\}, \{b\}, \{a, b\}, \{a, c\}, \{b, d\}, \{a, b, c\}, \{a, b, d\}\}$

Minbo(X) = $\{\emptyset, \{a\}, \{b\}\}$

Maxbo(X) = { X, {a, b, c}, $\{a, b, d\}$}

Parbo(X) = {{a, b}, {a, c},{b, d}}

π30=$\{\emptyset, X$, {a}, $\{b\}, \{c\}$, {a, b}, {a, c}, {b, c}, {a, b, c}, {a, b, d}}

π^C ={ X,Ø, $\{b, c, d\}$,$\{a, c, d\}$,{a,b,d},$\{c, d\}$,$\{b, d\}$,$\{a, d\}$,$\{d\}$,

bo(X) = {P(x)/{d},{c, d}}

Minbo(X) = $\{\emptyset, \{a\}, \{b\}, \{c\}\}$

Maxbo(X) = { X, {a, b, c},$\{a, b, d\}$, {a, c, d}}

Parbo(X) = {{a, b}, {a, c},{a, d} , {b, c},{b, d}}

$\pi 31=\{\emptyset, X, \{a\}, \{b\}, \{a, b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

$\pi^{C} = \{\{ X,\emptyset, \{b, c, d\},\{a, c, d\},\{c, d\},\{b,d\},\{b,c\},\{d\},\{c\},\{b\}$

$bo(X) = \{\emptyset, X, \{a\}, \{ b\}, \{a, c\}, \{a, d\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

$Minbo(X) = \{\emptyset, \{a\},\{ b\}\}$

$Maxbo(X) = \{X, \{a, b, c\}, \{a,b,d\}, \{a, c, d\}\}$

$Parbo(X) = \{\{a, b\}, \{a, c\}, \{a, d\}\}$

$\pi_{32}=\{\emptyset, X, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{a, b, c\},\{a , b, d\},\{a , c, d\}\}$

$\tau^{c=\{} X, \emptyset, \{b, c, d\},\{a,c,d\},\{a,b,d\},\{c,d\},\{b,d\},\{b,c\},\{a,d\},\{d\},\{c\},\{b\}$

$bo(X)=\{\emptyset, X, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}$

$Minbo(x)= \{\emptyset , \{a\}, \{b\}, \{c\}\}$

$Maxbo(X) = \{ X, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}\}$

$Par(X) = \{\{a, b\}, \{a, c\},\{a, d\},\{b, c\}\}$

$\pi 33=P(X)$

$\tau^{c} = P(X)$

$bo(X) =P(X)$

$Minbo(X) = \{\emptyset, \{a\}, \{b\}, \{c\},\{d\}\}$

$Maxbo(X) = \{ X, \{a, b, c\}, \{a, b, d\}, \{a, c, d\}, \{b, c, d\}\}$

$Parbo(x)= \{a, b\}, \{a, c\}, \{a, d\}, \{b, c\}, \{b, d\}, \{c, d\}$

Chapter Three

Definition3.1: Let (X,π) be a topological space. Then the space (X,π) is called Para b if (X,π) not minimal and maximal.

Definition3.2: T_0-Space

Let (X,π) be a topological space. Then the space (X,π) is called Para b T_0-**Space** iff for each pair of distinct points x,y$\in X$ there is Para b$0(X)$ containing x but not y or an Para b open set containing y but not x. I.e.,

Definition3.3: T_1-Space

Let (X,π) be a topological space. Then the space (X,π) is called Para b T_1-**Space** iff for each pair of distinct points x,y$\in X$ there is Para b -open set containing x but not y

Definition3.4: T_2-Space

Let (X,π) be a topological space. Then the space (X,π) is called Para b T_2-**Space** or Para b **Hausdorff space** iff for each pair of distinct points x,y$\in X$ there exist

Para b(X) open sets U And V s.t. $x \in U, y \in V \; And \; U \cap V = \emptyset$

X={a,b,c,d}	Para b- T_0-Space	Para b- T_1-Space	Para b- T_2-Space
π_1	1	1	1
π_2	1	0	0
π_3	1	0	1
π_4	1	1	1
π_5	1	1	1
π_6	1	1	1
π_7	1	0	0
π_8	1	0	0
π_9	1	0	0
π_{10}	1	0	0
π_{11}	1	0	1
π_{13}	1	0	1
π_{14}	1	0	0
π_{15}	1	0	0
π_{16}	1	0	0
π_{17}	1	0	1
π_{18}	0	0	0
π_{19}	0	0	0
π_{20}	1	0	0
π_{21}	1	0	0
π_{22}	1	0	0
π_{23}	1	0	0
π_{24}	1	1	1
π_{25}	0	1	0
π_{26}	0	0	0
π_{27}	0	0	0
π_{28}	1	1	1
π_{29}	1	1	1
π_{30}	1	0	1
π_{31}	1	0	0
π_{32}	1	0	0
π_{33}	1	1	1

پوختە

لەم کارەدا دوو کۆمەڵەمان بەکارهێناوە،س={أ،ب، ج}،{أ،ب،ج،د}هەندێک پێناسەمان لەسەر جێبەجێ کردووە ئەمانەمان دەستکەووتوە:

[bo(x),minbo(x),maxbo(x),parbo(x), T_0, T_1,T_2.]

References

[1]. D . Andrijevic , on b-open sets , Math. Vesnik, 48 (1996), 59-64. 112.

[2]. N .V . Veliˇcko, H-closed topological spaces , Mat . Sb . (N.S) 70(112)(1966),98.

[3]. A.S,Mashhour , M.E.Abdel_Mensef and I.Ahasanein , on par topological space Bull Math.Soc.Sci.R.S.R28(76)(1984) 39-45.

[4].F.Nakaoka and N.Oda, " Some Properties of Maximal Open Sets", IJMMS,no.21,pp1331-1340,2003.

[5]. F.Nakaoka and N.Oda, " Minimal closed Sets and Maximal closed Sets ", IJMMS,article ID18647,pp1-8,2006.

[6].F.Nakaoka and N.Oda, , " Some Properties of Maximal Open Sets", Int . J . Math .Math.Sci.21(2003).1331-1340.

[7].F.Nakaoka and N.Oda, , " Some Properties of Minimal Open Sets", Int . J . Math .Math.Sci.27(8)(2001).471-