Coc-b-connected spaces

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Abstract

We introduce and study the recall the notion of coc-b-connected space. And we prove many of the proposition and remarks which are related to it. And we discuss the definition of coc-b-locally connected, remarks and proposition about this concept . This study presents the definition of hyper connected by coc-b-open set. Also we give some proposition and remarks about this subject and give some important generalizations on this concept and we prove some results on the concept.

Introduction

In [5] M.C .Gemignani studied the concept of connected spaces and in [2] R. Engleking studied the characterizations of continuity provided that the continuous image of connected space is connected . Several properties of connected space in [11,10]. We recall that any two subsets A and B of a space X are called τ –separated iff $\overline{A} \cap B = A \cap \overline{B} = \emptyset$ see [8].

Definition(1):

Let X be topological space .Then A is called cocompact b-open set (notation : coc-b-open set) if for every $x \in A$, there exists an b-open set $U \subseteq X$ and a compact set K such that $x \in U - K \subseteq A$. The complement of coc-b-open set is called coc-b-closed set .

Remark(2):

Every open set is coc-b-open set.

But the converse is not true the following example shows: Let $X = \{a, b, c\}$

$\tau = \{X, \emptyset, \{a\}, \{b\}, \{a, b\}\}$. The coc-b-open sets are $\{X, \emptyset, \{a\}, \{b\}, \{c\}, \{a, c\}, \{a, b\}, \{b, c\}\}$.

Then $\{a, c\}$ is an coc-b-open but it is not open.

Definition(3):

Let $f: X \to Y$ be a function of a space X into a space Y then f is called an coc-b-continuous function if $f^{-1}(A)$ is an coc-b-open set in X for every open set A in Y .

Definition(4):

Let $f: X \to Y$ be a function of a space X into a space Y, then f is called an coc-b-irresolute (coc'-b-continuous for brief) function if $f^{-1}(A)$ is an coc-b-open set in X for every coc-b-open set A in Y.

Definition(5):

Let (X, τ) be topology space .Two subsets A and B of a space X are called coc-b-separated if $\overline{A}^{b-coc} \cap B = A \cap \overline{B}^{b-coc} = \emptyset$.

Definition(6): [9]

A subset A is said to be ω-open set if for each $x \in A$,there exists an open set U_x such that $x \in U_x$ and $U_x - A$ is countable.

Definition(7):

Let X be a space and $A \subseteq X$. The union of all coc-b-open sets of X contained in A is called coc-b-Interior of A and denoted by $A^{\circ b-coc}$ or coc-b-$In_\tau(A)$.

Coc-b-$In_\tau(A) = \cup\{B: B\ is\ coc-b-open\ in\ X\ and\ B \subseteq A\}$.

Definition(8):

Let (X,τ) be topology space and $\emptyset \neq A \subseteq X$. Then A is called coc-b-connected set if is not union of any two coc-b-separated sets .

Definition(9):

A set is called coc-b-clopen if it is coc-b-open and coc-b-closed.

Proposition(10):

Let (X,τ) be topological space ,then the following statements are equivalent :

1-X is coc-b-connected space .

2-The only coc-b-clopen sets in the space are X and $\emptyset$.

3-There exist no two disjoint coc-b-open sets A and B such that $X = A \cup B$.

Proof:

(1)→(2) Let X be coc-b-connected space ,suppose that D is coc-b-clopen set such that $D \neq \emptyset$ and $D \neq X$ .Let $E = X - D$ .Since $D \neq X$ then $E \neq \emptyset$. Since D is coc-b-open , then E is coc-b-closed .But $\overline{D}^{b-coc} \cap E = D \cap E = \emptyset$. (since D is coc-b-clopen set and E is coc-b-closed set) hence $D \cap E = D \cap \overline{E}^{b-coc} = \emptyset$. Then D and E are two coc-b-separated sets and $X = D \cup E$. Hence X is not coc-b-connected space which is a contradiction . Therefore the only coc-b-clopen set in the space are X and $\emptyset$.

(2)→(3) Suppose the only coc-b-clopen set in the space are X and $\emptyset$. Assume that there exists two disjoint coc-b-open W and B such that $X = W \cup B$ .Since $W = B^c$ then W is coc-b-clopen set .But $W \neq \emptyset$ and $W \neq X$ which is a contradiction .Hence there exists no two disjoint coc-b-open set W and B such that $X = W \cup B$.

(3)→(1) Suppose that X is not coc-b-connected space . Then there exist two coc-b-separated sets A and B such that $X = A \cup B$. Since $\overline{A}^{b-coc} \cap B = \emptyset$ and $A \cap B \subseteq \overline{A}^{b-coc} \cap B$ thus $A \cap B = \emptyset$. Since $\overline{A}^{b-coc} \subseteq B^c = A$ then A is coc-b-closed set and since $\overline{B}^{b-coc} \cap A = \emptyset$ and $A \cap B \subseteq \overline{B}^{b-coc} \cap A$ thus $A \cap B = \emptyset$, since $\overline{B}^{b-coc} \subseteq A^c = B$ then B is coc-b-closed set, since $A = B^c$ then A and B are two disjoint coc-b-open sets such that $X = A \cup B$ which is a contradiction .Hence X is coc-b-connected space .

Remark(11):

Every coc-b-connected space is connected space .But the converse is not true in general.

Example(12):

Let $X = \{1,2,3\}$ and $\tau = \{\emptyset, X, \{1\}, \{2\}, \{1,2\}\}$ then X is connected space but X is not coc-b-connected space since $\{2\}, \{1,3\}$ are coc-b-open set and $X = \{2\} \cup \{1,3\}$.

Proposition(13):

Let A be coc-b-connected set and D, E coc-b-separated sets .If $A \subseteq D \cup E$ then either $A \subseteq D$ or $A \subseteq E$.

Proof:

Suppose A be a coc-b-connected set and D ,E coc-b-separated sets and $A \subseteq D \cup E$ .Let $A \nsubseteq D$ and $A \nsubseteq E$.

Suppose $A_1 = D \cap A \neq \emptyset$ and $A_2 = E \cap A \neq \emptyset$ then $A = A_1 \cup A_2$ .Since $A_1 \subseteq D$ hence $\overline{A_1}^{b-coc} \subseteq \overline{D}^{b-coc}$,since $\overline{D}^{b-coc} \cap E = \emptyset$ then $\overline{A_1}^{b-coc} \cap A_2 = \emptyset$,since $A_2 \subseteq E$ hence $\overline{A_2}^{b-coc} \subseteq \overline{E}^{b-coc}$, since $\overline{E}^{b-coc} \cap D = \emptyset$ then $\overline{A_2}^{b-coc} \cap A_1 = \emptyset$ .But $A = A_1 \cup A_2$ therefore A is not coc-b-connected space which is a contradiction .Then either $A \subseteq D$ or $A \subseteq E$.

Proposition(14):

Let (X,τ) be a topological space such that any two element x and y of X are contained in some coc-b-connected subspace of X. Then X is coc-b-connected .

Proof:

Suppose X is not coc-b-connected. Then X is the union of two coc-b-separated sets A ,B. Since A, B are nonempty sets. Thus there exists a, b such that $a \in A$, $b \in B$. Let D be coc-b-connected subspace of X which contains a, b. Therefore either $D \subseteq A$ or $D \subseteq B$ which is a contradiction (since $A \cap B = \emptyset$). Then X is coc-b-connected space .

Proposition(15):

If A is coc-b-connected set then $\overline{A}^{b-coc}$ is coc-b-connected .

Proof:

Suppose A is coc-b-connected and $\overline{A}^{b-coc}$ is not coc-b-connected. Then there exist two coc-b-separated set D, E such that $\overline{A}^{b-coc} = D \cup E$. But $A \subseteq \overline{A}^{b-coc}$,then $A \subseteq D \cup E$ and since A is coc-b-connected set. Then either $A \subseteq D$ or $A \subseteq E$. If $A \subseteq D$ then $\overline{A}^{b-coc} \subseteq \overline{D}^{b-coc}$. But $\overline{D}^{b-coc} \cap E = \emptyset$, hence $\overline{A}^{b-coc} \cap E = \emptyset$ since $\overline{A}^{b-coc} = D \cup E$. Then $E = \emptyset$ which is a contradiction .If $A \subseteq E$ then $\overline{A}^{b-coc} \subseteq \overline{E}^{b-coc}$. But $\overline{E}^{b-coc} \cap D = \emptyset$,hence $\overline{A}^{b-coc} \cap D = \emptyset$ since $\overline{A}^{b-coc} = E \cup D$. Then $D = \emptyset$ which is a contradiction .Then $\overline{A}^{b-coc}$ is coc-b-connected.

Proposition(16):

If D is coc-b-connected set and $D \subseteq E \subseteq \overline{D}^{b-coc}$ then E is coc-b-connected .

Proof:

Let D be coc-b-connected set and $D \subseteq E \subseteq \overline{D}^{b-coc}$ .Suppose E is not coc-b-connected ,then there exist two sets A, B such that $\overline{A}^{b-coc} \cap B = A \cap \overline{B}^{b-coc} = \emptyset$, $E = A \cup B$, since $D \subseteq E$, thus either $D \subseteq A$ or $D \subseteq B$ .Suppose $D \subseteq A$ then $\overline{D}^{b-coc} \subseteq \overline{A}^{b-coc}$, thus $\overline{D}^{b-coc} \cap B = \overline{A}^{b-coc} \cap B = \emptyset$. But $D \subseteq E \subseteq \overline{D}^{b-coc}$,then $\overline{D}^{b-coc} \cap B = B$ .Therefore $B = \emptyset$ which is a contradiction, hence E is coc-b-connected set.

Proposition(17):

If a space X contains a coc-b-connected subspace E such that $\overline{E}^{bcoc} = X$ then X is coc-b-connected .

Proof:

Suppose E a coc-b-connected subspace of a space X such that $\overline{E}^{b-coc} = X$, since $E \subseteq X = \overline{E}^{b-coc}$ then by proposition (2.3.11) then X is coc-b-connected .

Lemma(18):

If A is subset of a space X which is both coc-b-open and coc-b-closed sets, then any coc-b-connected subspace $C \subseteq X$ which meets A must be contained in A.

Proof:

If A is coc-b-open and coc-b-closed sets in X then $C \cap A$ coc-b-open and coc-b-closed in C ,if C is coc-b-connected this implies that $C \cap A = C$ which says that C is contained in A.

Proposition(19):

The coc-b-continuous onto image of coc-b-connected space is connected.

Proof:

Let $f: (X, \tau) \to (Y, \tau')$ be coc-b-continuous, onto function and X is coc-b-connected .To prove that Y is connected .Suppose Y is a not connected space . So $Y = A \cup B$ such that $A \neq \emptyset$, $B \neq \emptyset$ and $A \cap B = \emptyset$ and A , $B \in \tau'$ hence $f^{-1}(Y) = f^{-1}(A \cup B)$, then $X = f^{-1}(A) \cup f^{-1}(B)$. Since f is coc-b-continuous hence $f^{-1}(A)$ and $f^{-1}(B)$ are coc-b-open in X and sine that $A \neq \emptyset, B \neq \emptyset$ and f is onto .Then $f^{-1}(A) \neq \emptyset$, $f^{-1}(B) \neq \emptyset$ and $f^{-1}(A) \cap f^{-1}(B) = \emptyset$,hence X is not coc-b-connected space which is contradiction .Then Y is connected .

Corollary(20):

The coc'-b-continuous image of coc-b-connected space is coc-b-connected.

Proof:

Let $f: (X, \tau) \to (Y, \tau')$ be coc'-b-continuous, onto function and X is coc-b-connected. To prove Y is coc-b-connected. Suppose Y is not coc-b-connected space. So, $Y = A \cup B$ such that $A \neq \emptyset$, $B \neq \emptyset$ and $A \cap B = \emptyset$ and A, B

are coc-b-open sets, hence $f^{-1}(Y) = f^{-1}(A \cup B)$ then $X = f^{-1}(A) \cup f^{-1}(B)$. Since that f coc'-b-continuous ,hence $f^{-1}(A)$ and $f^{-1}(B)$ are coc-b-open in X and since that $A \neq \emptyset$, $B \neq \emptyset$ then $f^{-1}(A) \neq \emptyset$, $f^{-1}(B) \neq \emptyset$ and $f^{-1}(A) \cap f^{-1}(B) = \emptyset$, hence X is not coc-b-connected space which is contradiction .Then Y is coc-b-connected .

Proposition(21):
Let X be topological space and let $Y = \{0,1\}$ have the discrete space. Then X is coc-b-connected iff there is no coc-b-continuous function from X onto Y.

Proof:

Suppose $f: (X, \tau) \to (Y, \tau')$ is coc-b-continuous onto function. So there exists $x , y \in X$ such that $x \neq y$, $f(x) = 0, f(y) = 1$. Then $f^{-1}(\{0\}) = A$, $A \subseteq X$ and $f^{-1}(\{1\}) = B$, $B \subseteq X$ therefore A and B are coc-b-open set in X .Since f is coc-b-continuous .Hence $X = A \cup B$ such that $A \neq \emptyset$, $B \neq \emptyset$. A , B are coc-b-open sets which is a contradiction .Since X is coc-b-connected .

Conversely, let X be not coc-b-connected. Then $X = A \cup B$ such that $A \neq \emptyset$, $B \neq \emptyset$, $A \cap B = \emptyset$ and A , B are coc-b-open sets. Define $g: (X, \tau) \to (Y, \tau')$ such that $g(x) = 0 \ \forall x \in A$ and $g(x) = 1 \ \forall x \in B$,hence g is coc-b-continuous ,which is contradiction .Then X is coc-b-connected.

Definition(22): [4]
Let $f: X \to Y$ be a function of a space X into a space Y. Then f is called a ω-continuous function if $f^{-1}(A)$ is an ω-open set in X for every open set A in Y.

Definition(23): [6]
A subset A of a space X is called an ω-set if $A = U \cup V$ when U is open set and $Int(V) = Int_{\omega}(V)$.

Definition(24): [7]
A space (X, τ) is said to be satisfy ω-condition if every ω-open is ω-set.

Lemma(25): [6]
A subset A of a space X is open iff A ω-open set and ω-set .

Definition(26): [1]
A space X is said to be ω-connected provided that X is not the union of two nonempty disjoint ω-open sets .

Proposition(27):
Let (X, τ) and (Y, τ') be two topological spaces. If satisfy ω- condition ,then the coc-b-continuous, onto image of coc-b-connected space is ω-connected .

Proof:

Let $f: (X, \tau) \to (Y, \tau')$ be coc-b-continuous, onto function and X be coc-b-connected. To prove Y is ω-connected. Suppose Y is not ω-connected space. So, $Y = \{A \cup B\}$ such that $A \neq \emptyset$, $B \neq \emptyset$ and $A \cap B = \emptyset$ and A , B ω-open sets since Y satisfy ω-condition , then A , B are open sets. Hence $f^{-1}(Y) = f^{-1}(A \cup B)$. Then $X = f^{-1}(A) \cup f^{-1}(B)$. Since that f coc-b-continuous hence $f^{-1}(A)$ and $f^{-1}(B)$ are coc-b-open in X .Since that $A \neq \emptyset$, $B \neq \emptyset$ and f is onto then $f^{-1}(A) \neq \emptyset$, $f^{-1}(B) \neq \emptyset$ and $f^{-1}(A) \cap f^{-1}(B) = \emptyset$, hence X is not coc-b-connected space which is contradiction .Then Y is ω-connected.

Definition(28): [3]
A space (X, τ) is said to be locally connected if for each point $x \in X$ and each open set U such that $x \in U$. There is a connected open set V ,$x \in V \subseteq U$.

Definition(29):
A space (X, τ) is said to be coc-b-locally connected if for each point $x \in X$ and each coc-b-open set U such that $x \in U$. There is a coc-b-connected open set V ,$x \in V \subseteq U$.

Proposition(30):
Every coc-b-locally connected space is locally connected space.

Proof: Clear

Remark(31):
The convers of the proposition (24) is not true in general.

Example(32):
Let $X = \{1,2,3\}$, $\tau = \{X, \emptyset, \{2,3\}\}$ .The coc-b-open sets are
$X, \emptyset, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}, \{2,3\}$ then (X, τ)

is locally connected but (X,τ) is not coc-b-locally. Since $1 \in \{1,2\}$. There is no coc-b-connected open set V such that $1 \in V \subseteq \{1,2\}$.

Remark(33):
If (X,τ) is a coc-b-locally connected space. Then it need not be coc-b-connected .

Example(34):
Let $X = \{1,2,3\}$,
$\tau = \{X, \emptyset, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}, \{2,3\}\}$.
The coc-b-open sets is discrete topology then (X,τ) is a coc-b-locally but (X,τ) is not coc-b-connected ,since $\{1\}, \{2,3\}$ are coc-b-open sets in X such that $X = \{1\} \cup \{2,3\}$ and $\{1\} \cap \{2,3\} = \emptyset$.

Definition(35):
Let (X,τ) be any space, a maximal coc-b-connected of X is said to be coc-b-component of X.

Theorem(36):
For a space (X,τ). The following condition are equivalent:

1-X is a coc-b-locally connected.

2-Every coc-b-component of every coc-b-open set is open.

Proof:

(1)→(2) Let X be coc-b-locally connected and let C be coc-b-component of X such that $x \in C$. Let $x \in X$ and A is coc-b-open set in X such that $x \in C \subseteq A$. Then $x \in A$ and A is coc-b-open set in X . Since X is a coc-b-locally connected , then there exist coc-b-connected open set V in X such that $x \in V \subseteq A$,since that C is coc-b-component ,then $V \subseteq C$ and $\bigcup_{x \in C} V_x \subseteq C$,hence $C = \bigcup_{x \in X}\{V_x : x \in C\}$ therefore C is open set.

(2)→(1) Let $x \in X$ and U be coc-b-open set in X such that $x \in U$ and let C coc-b-component of U such that $x \in C \subseteq U$. Then C is open set in X by (2) . Since that C is coc-b-component, hence C is coc-b-connected .Therefore X is a coc-b-locally connected.

Proposition(37):
The coc-b-continuous, open, image of coc-b-locally connected space is locally connected.

Proof:

Let $f:(X,\tau) \to (Y,\tau')$ be coc-b-continuous open and onto function and (X,τ) is coc-b-locally connected space. To prove (Y,τ') is locally connected. Let $y \in Y$ and U be open set in $Y \ni y \in U$. Since f is onto there exist $x \in X$ such that $f(x) = y$, since f is coc-b-continuous then $f^{-1}(U)$ is coc-b-open set in X such that $x \in f^{-1}(U)$, since X is coc-b-locally connected then there exist V is coc-b-connected open set in X such that $x \in V \subseteq f^{-1}(U)$ since f open function, then $f(x) \in f(V) \subseteq U$ such that $f(V)$ is open and $f(V)$ is connected by corollary(14). Therefore Y is a locally connected .

Remark(38):
The coc-b-continuous image of coc-b-locally connected need not be coc-b-locally connected.

Example(39):
Let $X = \{1,2,3\}$, $Y = \{a,b,c\}$,
$\tau = \{\emptyset, X, \{1\}, \{2\}, \{3\}, \{1,2\}, \{2,3\}, \{1,3\}\}$ and $\tau' = \{\emptyset, Y, \{a\}\}$. The coc-b-open set in X and Y are discrete topology. Define $f:(X,\tau) \to (Y,\tau')$ such that $f(1) = a$, $f(2) = b$, $f(3) = c$ is coc-b-continuous, onto function .Then (X,τ) is coc-b-locally connected but (Y,τ') is not coc-b-locally connected since $b \in \{a,b\}$ and exists no coc-b-connected open set V in X such that $b \in V \subseteq \{a,b\}$.

Proposition(40):
The coc'-b-continuous, open, image of coc-b-locally connected space is coc-b-locally connected.

Proof:

Let $f:(X,\tau) \to (Y,\tau')$ be coc'-b-continuous, open and onto function and (X,τ) is coc-b-locally connected space . To prove (Y,τ') is coc-b-locally connected, let $y \in Y$ and U is coc-b-open set in Y, such that $y \in U$. Since f onto there exist $x \in X$ such that $f(x) = y$ for each $y \in Y$, since f is coc'-b-continuous, hence $f^{-1}(U)$ is coc-b-open set in X such that $x \in f^{-1}(U)$. Since X is coc-b-locally connected then $\exists\ V$ coc-b-connected open set in X such that $x \in V \subseteq f^{-1}(U)$, since f is open then $f(V)$ is open set in Y and $f(V)$ is coc-b-connected by proposition (15). Hence $f(V)$ is coc-b-connected open set in Y such that $y \in f(V) \subseteq U$. Therefore Y is a coc-b-locally connected space.

Definition(41):
Let X be a space ,$A \subseteq X$, A is called coc-b-dence set in X if $\overline{A}^{b-coc} = X$.

We recall that a space X is said to be hyper connected if for every nonempty open subset of X is dence see [5] .

Definition(42):
A space X is said to be coc-b-hyper connected if for every nonempty coc-b-open subset of X is coc-b-dence.

Now, we explain the relation between an coc-b-hyper connected space and hyper connected space .

Proposition(43):
Every coc-b-hyper connected space is hyper connected.

Proof:

Let X be coc-b-hyper connected space. Then every nonempty coc-b-open subset of X is coc-b-dence in X, hence every nonempty open subset of X is dence. Therefore X is hyper connected (since every coc-b-dence set is dence).

Remark(44):
The convers of the proposition (43) is not true in general.

Example(45):
Let $X = \{1,2,3\}$, $\tau = \{X, \emptyset\}$. The coc-b-open sets $\{X, \emptyset, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}, \{2,3\}\}$. Then (X, τ) is hyper connected but (X, τ) is not coc-b-hyper connected since $\{1\}$ is coc-b-open set and $\overline{\{1\}}^{b-coc} = \{1\} \neq X$.

Proposition(46):
Every coc-b-hyper connected space is coc-b-connected.

Proof:

Let X be coc-b-hyper connected space and suppose X is not coc-b-connected. Then there exists A is coc-b-clopen subset in X such that $A \neq \emptyset$ and $A \neq X$, hence $A = \overline{A}^{b-coc}$ which is a contradiction, since X is coc-b-hyper connected. Therefore X is coc-b-connected .

Definition(47): [2]
A space (X, τ) is said to be extremally disconnected if the closure of every open subset of X is open in X.

Definition(48):
A space (X, τ) is said to be coc-b-extremally disconnected if the closure of every open is coc-b-open.

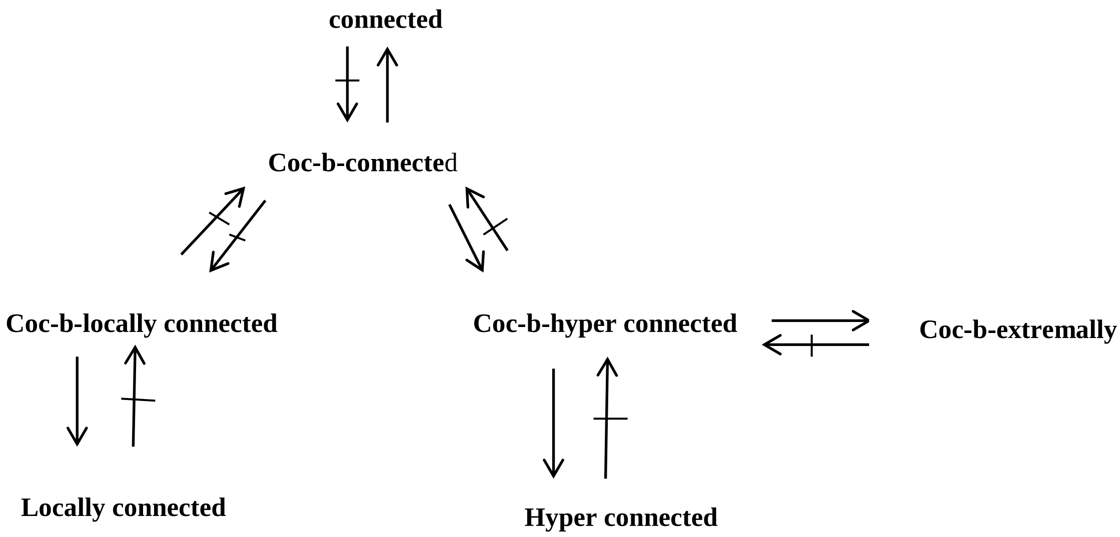
Remark(49):
Every extremally disconnected space is coc-b-extremally disconnected space and the convers is not true in general.

Example(50):
Let $X = \{a, b, c\}$, $\tau = \{X, \emptyset, \{a\}, \{b\}, \{a, b\}\}$ .The coc-b-open set $\{X, \emptyset, \{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}\}$ .Then (X, τ) is coc-b-extremally disconnected, but (X, τ) is not extremally disconnected since $\overline{\{a\}} = \{a, c\} \notin \tau$.

Remark(51):
Every coc-b-hyper connected is a coc-b-extremally disconnected space but the convers is not true in general.

Example(52):
Let
$X = \{1,2,3\}$,
$\tau = \{X, \emptyset, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}, \{2,3\}\}$. The coc-b-open set
$X, \emptyset, \{1\}, \{2\}, \{3\}, \{1,2\}, \{1,3\}, \{2,3\}$. Then (X, τ) is coc-b-extremally disconnected since the closure of every open subset of X is coc-b-open. But (X, τ) is not coc-b-hyper connected since $\overline{A}^{b-coc} = A \neq X\ \ \forall\ A$ coc-b-open.

The following diagram explain the relationship among these types of connected spaces



References

[1] A .AL-Omari and M.S.Md. Noorani , "contra-ω-continuous and almost contra-ω-continuous" , Internet. J.Math..Math. Sci., Vo. 2007.

[2] R. Engleking "General topology", Sigma Seres in pure mathematics ,VI .6 ISBN 3-88538-006-4,1989.

[3] M. C. Gemignani, "Elementary Topology", Reading, Mass: Addison-Wesley Publishing Co. Inc. , (1967).

[4] N. Rajesh , P. Sudha, "On weakly ω-Continuous Functions" International Journal of Pure and Applied Mathematics, Volume 86 No. 2 2013, 325-332.

[5] N. J. Al-Malaki, "Some Kinds of Weakly Connected and Pairwise Connected Space", M.Sc. Thesis University of Baghdad, College of Education \ Abn AL-Haitham , 2005.

[6] T. Noiri , A. Al-Omari , and Mohd. Salmi Md .Noorani " Weak forms of ω-open sets and decompositions of continuity " European journal of pure and applied mathematics vol.2,No.1. pp. 73-84,2009.

[7] M.H Hadi and L.A. Al-SWidi, "Characterizations of Continuity and compacteness with Respect to Weak Forms of ω-open sets ", European Journal of Scientific Research ISSN 1450-216X Vol. 57 No.4(2011).

[8] S. Lipschutz , "Schom s Outline Series; Theory and Problem of General Topology" , New York , St. Louis , San Francisco , Toronto, Sydney, (1995).

[9] H. Z . Hdeib ," closed mapping ", Rev.Colomb .Math.16(1-2) (1982),65-78.

[10] Sema Kadhim Gaber , "On b-Dimension Theory ", M .S. c. Thesis University of AL-Qadissiya , College of Mathematics and computer Science , 2010.

[11] Y. Katuta "On strongly normal spaces" Proc, Japan Acad. ,45,(1969) ,692-695.

الفضاءات المتصلة من النمطcoc-b

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الخلاصة

نحن نقدم و ندرس الفضاء المتصل من النمط coc-b ،حيث نقدم عدد من المبرهنات والملاحظات حول هذا المفهوم والنتائج التي تخص ذلك و كذلك نقوم بمناقشة تعريف المتصل محليا من النمطcoc-b أيضا نقدم بعض الملاحظات والمبرهنات حول المفهوم الجديد. في هذه الدراسة أيضا نقدم تعريف hyper connected باستخدام المجموعة المفتوحة من النمط coc-b ونعطي المبرهنات والملاحظات التي تخص ذلك المفهوم.