Quest Journals
Journal of Research in Applied Mathematics
Volume 1 ~ Issue 1 (2013) pp: 01-09
ISSN(Online) : 2394-0743 ISSN (Print): 2394-0735
www.questjournals.org

Research Paper

Bitopological separation axioms via S**G -open set

Dr. Rajpal Singh
Lecturer In Mathematics , R. R. Govt College , Alwar , Rajasthan , 301001

ABSTRACT
In this paper, we define a ii-open set in a bitopological space as follows: Let (X, T1, T2) be a bitopological space, a subset A of X is called a (TT_2 -ii- open set) if there exists U ,V0,X and UVET UT_2 such that: A=int^2 (V) 1. A=int^1(U) 2. AC CL (ANU) or or A≤ CL^2 (ANV) We study some characteristics and properties of this class. We also explain the relation between ii-open sets and open sets, i-open sets and a-open sets in bitopological space. Next, we define ii-continuous mappings on bitopological spaces with some properties.
***Keywords:* a- open set, i- open set, ii- open set, bitopological space. , Pairwise S**G - Separation axioms**

I. Introduction

Let A be a subset of the topological space (X,), then the union of all s**g open sets contained in the subset A of X is called the s**g interior of A and denoted by s**g int (A). The intersection of all s**g closed sets X containing a subset A of X is called the s**g closure of A and is denoted by s**g cl(A).
In this chapter we will consider pairwise s**g - Ri spaces [i = 0, 1], pairwise s**g - Ti spaces [i = 0, 1, 2, 3, 4, 5], pairwise s** g - regular spaces, even s**g - Urysohn spaces, even s**g - normal spaces, even s**g - completely normal spaces in bitopological spaces.

Pairwise S**G - Separation axioms

In this section, the concept of pairwise s**g-separation axioms is introduced and its basic properties in bitopological spaces are discussed.

Definition Let (X, 1, 2) be a bitopological space and let A X then the

intersection of all 1 2 - s**g - closed sets of X containing a subset A of X is

called 1 2 - s**g closure of A and is denoted by 1 2 - s**g cl(A).

Definition Let (X, 1, 2) be a bitopological space and let A X then the

union of all 1 2 - s**g open sets contained in a subset A of X is called 1 2 -

s**g interior of A and is denoted by 1 2 - s**g int(A).

Definition A bitopological space (X, 1, 2) is pairwise s**g- R0 if for each

i - s**g - open set G, x G implies j - s**g- cl({x}) G, where i, j = 1, 2 and

i $\neq$ j.

Example Let X = {a, b, c}, τ1 = { , X, {a, c}} and τ2 = { , X, {b, c}}.

Clearly the space (X, 1, 2) is pairwise s**g - R0.

Theorem In a bitopological space (X,1,2) the following statements are equivalent :-

(X, 1, 2) is pairwise s**g- R0.

For any i - s**g - closed set F and a point x F, there exists a U s**gO(X, j) such that x U and F U for i, j = 1, 2 and i ≠ j.

For any i -s**g - closed set F and a point x F, j - s**g - cl({x})

F = , for i, j = 1, 2 and i ≠ j.

Proof. i) ii) : Let F be a i - s**g - closed set F and a point x F. Then by

i), j - s**g-cl ({x}) X – F, where i, j = 1, 2 and i ≠ j. Let U = X –j - s**g -

cl({x}) then U s**gO(X, j) and also F U and x U.

iii) : Let F be a i - s**g - closed set F and a point x F. Suppose the given conditions hold. Since U s**gO(X, j), U i - s**g -cl({x}) = . Then F j - s**g-cl({x}) = , where i, j = 1, 2 and i ≠ j.

i) : Let G s**gO(X, i) and x G. Now X – G is i - s**g closed and x X – G. By iii), j - s**g -cl({x}) (X – G) = and hence j - s**g - cl({x}) G for i, j = 1, 2 and i ≠ j. Therefore, the space (X, 1, 2) is pairwise s**g- R0.

Definition A space (X, 1, 2) is said to be pairwise s**g- R1 if for each x,

y X, i - s**g -cl({x}) ≠ j - s**g- cl({y}), there exist disjoint sets U

s**gO(X, j) and V s**gO(X, i) such thati - s**g- cl({x}) U and j -

s**g- cl({y}) V where i, j = 1, 2 and i ≠ j.

Example Let X = {a, b, c}, τ1 = { , X, {b, c}} and τ2 = { , X, {a}}. Clearly the space (X,1,2) is pairwise s**g - R1.

Theorem If (X,1,2) is pairwise s**g - R1, then it is pairwise s**g- R0.

Proof. Suppose that (X, 1,2) is pairwise s**g- R1. Let U be a j - s**g - open

set and xU. If y U, then y X – U and x j - s**g - cl({y}). Therefore,

for each point y X – U, i - s**g -cl({x}) ≠ j - s**g - cl({y}). Since (X, 1,

2) is pairwise s**g- R1, there exist a j - s**g - open set Uy and a i - s**g- open

set Vy such that i - s**g- cl({x}) Uy, j - s**g - cl({y}) Vy and Uy Vy =

, where i, j = 1, 2 and i ≠ j. Let A = {Vy / y X – U}, then X – U A, x

A and A is j - s**g- open set. Therefore, j - s**g - cl({x}) X – A U.

Hence (X, 1, 2) is pairwise s**g- R0.

Theorem A space (X,1,2) is pairwise s**g- R1 if and only if for every

pair of points x and y of X such that i - s**g- cl({x}) j - s**g - cl({y}), there

exists a j - s**g- open set U and i - s**g- open set V such that x V, y U

and U V = , where i, j = 1, 2 and i j.

*Corresponding Author: Dr. Rajpal Singh

Proof. Suppose that (X, 1, 2) is pairwise s**g- R1. Let x, y be points of X such

that s**g -cl({x}) s**g - cl({y}), where i, j = 1, 2 and i j. Then there exist a

i - s**g- open set U and j - s**g- open set V such that x i - s**g - cl({x})

V, yj - s**g - cl({y})U and it follows that U V = , where i, j = 1,

On the other hand, suppose there exist a j - s**g - open set U and i - s**g-open set V such that x V, y U and U V = , where i, j = 1, 2 and i j. Since every pairwise s**g- R1 space is every pairwise s**g- R0, i -s**g -cl({x})

V and j - s**g - cl({y}) U from which we infer that i -s**g - cl({x})i

-s**g - cl({y}) for i, j = 1, 2 and i j.

Remark The converse of theorem need not be true in general. The space

(X, 1, 2) [in Example 2.2.1.] is pairwise s**g- R0 but not pairwise s**g- R1.

Theorem In a bitopological space (X,1,2) the following statements are

equivalent :

(X, 1, 2) is pairwise s**g- R1

For any two distinct points x, y X, i - s**g-cl({x}) j - s**g-cl({y}) implies that there exists a i - s**g- closed set F1 and a j - s**g- closed

set F2 such that x F1, y F2 , x F2 , y F1 and X = F1 F2 , i, j = 1, 2 and i

j.

Proof. (i) **(ii) :** Suppose that (X, 1, 2) is pairwise s**g - R1. Let x , y X

such that i - s**g-cl({x}) j - s**g-cl({y}). By Theorem 2.2.1, then there exist

disjoint sets V s**gO(X, i), U s**gO(X, j) such that x U, y V and

U V = , where i, j = 1, 2 and i j. Then F1 = X – V is a i - s**g- closed set

and F2 = X – U is a i - s**g - closed set such that x F1, x F2, y F1, y

F2and X = F1 F2 where i, j = 1, 2 and i j.

(i) : Let x, y X such that i - s**g - cl({x}) j - s**g - cl({y}) where i, j = 1, 2 and i j. By (ii), there exists a i - s**g- closed set F1 and a j - s**g - closed set F2 such that X F1 F2, x F1, y F2, x F2, y F1. Therefore, x X – F2 = U s**gO(X, j) and y X – F1 = V s**gO(X, i

) which implies that i - s**g- cl({x}) U and j -s**g- cl({y}) V and U V = where i, j = 1, 2 and i j.

Definition A bitopological space X is called pairwise s**g- T0 if for any

pair of distinct points x, y of X, there exists a set which is either i - s**g - open or j - s**g - open containing one of the points but not the other, where i, j = 1,

2 and i ≠ j.

Theorem A bitopological space X is called pairwise s**g- T0 if either (X, 1) or (X, 2) is s**g- T0.

Proof. The proof is obvious.

Theorem The product of an arbitrary family of pairwise s**g- T0 space is pairwise s**g- T0.
Proof Let (X, 1, 2) = $\prod_{\alpha \in \Delta}(X_\alpha, \tau_{1\alpha}, \tau_{2\alpha})$, where 1 and 2 are the product topologies on X generated by $\tau_{1\alpha}$ and $\tau_{2\alpha}$ respectively and X = $\prod_{\alpha \in \Delta} X_\alpha$. Let x

(x_α) and y = (y_α) be two distinct points of X. Hence $x_\alpha \neq y_\alpha$ for some . But (X_λ, $\tau_{1\lambda}$, $\tau_{2\lambda}$) is pairwise s**g - T0, there exist either a $\tau_{1\lambda}$- s**g- open set

U containing x_λ but not y_λ or a $\tau_{2\lambda}$ - s**g- open set V_α containing y_λ but not x_λ. Define U = $\prod_{\lambda \neq \alpha}(X_\lambda \times U_\alpha)$ and V = $\prod_{\lambda \neq \alpha}(Y_\lambda \times V_\alpha)$. Then U is τ_1- s**g - open and V is τ_2- s**g - open. Also, U contains x but not y.

Definition A bitopological space X is called pairwise s**g - T1 if for every distinct points x, y of X, there is a τi - s**g - open set U and a τj - s**g - open
set V such that x U, y U and y V, x V, where i, j = 1, 2 and i ≠ j.

Example Let X = {a, b, c}, τ1 = { , X, {a, c}} and τ2 = { , X, {b, c}}.

Clearly τ1 - s**gO(X) = { , X, {a}, {c},{a, c}}and τ2 - s**gO(X) = { , {c}, {b,

c}, {b}, X}. Then the bitopological space (X, τ1, τ2) is called pairwise s**g- T1.

Remark Since a bitopological space (X, 1, 2) is pairwise s**g- T1 if and only if the singletons are τj - s**g - closed, it is clear that every pairwise s**g-T1 is pairwise s**g- R0. But the converse is not true in general as it can be seen from the following example:

Example Let X = {a, b, c}, τ1 = τ2 ={ , X, {a},{b, c}}. It is clear that τ1

s**gO(X) = τ2 - s**gO(X) = { , {a}, {b, c}, X}. Then the bitopological space (X, 1, 2) is pairwise s**g- R0 but not pairwise s**g- T1 .

Remark The following example shows that the notions pairwise s**g - T0 - ness and pairwise s**g- R0 - ness are independent.

Example Let X = {a, b, c, d}, τ1 = τ2 ={ , X, {a},{a, b}}. It is clear that

τ1 - s**gO(X) = τ2 - s**gO(X) = { , {a}, {a, b, c}, {a, b}, X}. Then the

bitopological space (X, 1, 2) is pairwise s**g- T0 but not (X, 1, 2) is pairwise

s**g - R0. Also the bitopological space (X, 1, 2) as in example is pairwise

s**g- R0 but not pairwise s**g- T0 .

Corollary A bitopological space X is pairwise s**g- T1 iff if it is pairwise s**g- T0 and pairwise s**g - R0.

Lemma If every finite subset of a bitopological space (X, 1, 2) is τj -

s**g closed then it is pairwise s**g - T1.

Proof Let x, y X such that x y. Then by hypothesis, {x} and {y} are τj - s**g - closed sets in X. Hence X \ {x}and X \ {y} are τi - s**g - open subsets of X such that x X \ {x} and y X \ {y}. Therefore, (X, 1, 2) pairwise s**g- T1.

Theorem The product of an arbitrary family of pairwise s**g - T1 space is pairwise s**g -T1.

Proof Let (X, 1, 2) = $\prod_{\alpha \in \Delta}(X_\alpha, \tau_{1\alpha}, \tau_{2\alpha})$, where 1 and 2 are the product topologies on X generated by $\tau_{1\alpha}$ and $\tau_{2\alpha}$ respectively and X = $\prod_{\alpha \in \Delta} X_\alpha$. Let x = ($x_\alpha$) and y = ($y_\alpha$) be two distinct points of X. Hence $x_\alpha \neq y_\alpha$ for some .

But (X_λ, $\tau_{1\lambda}$, $\tau_{2\lambda}$) is pairwise s**g – T1, there exist a $\tau_{1\lambda}$- s**g- open set U containing x_λ but not y_λ and there exist a $\tau_{2\lambda}$ - s**g- open set V_α containing y_λ but not x_λ. Define U = $\prod_{\lambda \neq \alpha}(X_\lambda \times U_\alpha)$ and V = $\prod_{\lambda \neq \alpha}(Y_\lambda \times V_\alpha)$. Then U is τ_1- s**g - open set and V is τ_2- s**g – open set. Also, U contains x but not y and V contains y but not x.

Theorem A bitopological space X is called pairwise s**g - T1 if either

(X, 1) or (X, 2) is s**g - T1.

Proof. Let(X, 1, 2) be pairwise s**g - T1 space. Let x, y be two distinct points

of X, then there exists a 1 - s**g - open set U such that x U, y U. Thus,

(X, 1) is s**g - T1. Similarly, (X, 2) is s**g - T1. Converse is obvious.

Definition A bitopological space X is called pairwise s**g - T2 or

pairwise s**g - Hausdorff if given distinct points x, y of X, there is a i - s**g

- open set U and a i - s**g - open set V such that x U, y V, U V =

where i, j = 1, 2 and i ≠ j.

Corollary A bitopological space X is pairwise s**g - T2 iff if it is pairwise s**g - T1 and pairwise s**g - R1.

Theorem Every pairwise s**g - T2 space is pairwise s**g - T1 space. **Proof.** Let X is pairwise s**g - T2 space. Since X is pairwise s**g - T2 space,
there exists a i - s**g - open set U and a j - s**g - open set V such that x

U, y V, U V = , where i, j = 1, 2 and i ≠ j. x U, but y U and y V

but x V. X is pairwise s**g - T1 space, there is a τi - s**g - open set U and

a τj - s**g - open set V such that x U, y U and y V, x V, where i, j =

1, 2 and i ≠ j.

In general the converse of the above theorem need not be true and it can be seen from the following example.

Example Let X = {a, b, c}, τ1 = { , X, {a, c}}, τ2 = { , X, {b, c}}. Clearly the bitopological space (X, τ1, τ2) is pairwise s**g - T1 but not pairwise s**g - T2.

Remark Every pairwise s**g - T1 space is pairwise s**g - T0.

Theorem If a space (X, 1, 2) is pairwise s**g - T2, then it is pairwise s**g - R1.

Proof. Let (X, 1, 2) be pairwise s**g - T2. Then for any two distinct points x,

y of X, their exist a τi - s**g - open set U and a τj - s**g - open set V such that x

U, y V and U V = where i, j = 1, 2 and i ≠ j. If (X, 1, 2) is pairwise s**g - T1, then {x} = τi - s**g - cl({x}) and {y} = τj s**g - cl({y}) and thus τi

s**g - cl({x}) ≠ τi - s**g - cl({y}), where i, j = 1, 2 and i ≠ j. Thus for any

distinct pair of points x, y of X such that τi - s**g - cl({x}) ≠ τi - s**g - cl({y}) where i, j = 1, 2 and i ≠ j, there exists a τj - s**g - open set U and τi - s**g - open set V such that x V, y U and U V = where i, j = 1, 2 and i ≠ j. Hence (X, 1, 2) is pairwise s**g - R1.

Remark The converse of the above theorem is not true in general that is pairwise s**g - R1 space is not pairwise s**g - T2 space.

Remark If a bitopological space X pairwise s**g - Ti, then it is pairwise s**g - T i – 1, i = 1,2.

Definition Let X be a bitopological space. Then τi is s**g - regular w.r.to

τj if for each point x in X and each τi - s**g - closed set P such that x P there

is a τi - s**g - open set U and a τj - s**g - open set V disjoint from U such that

x U and P V. X is pairwise s**g - regular if τi is s**g - regular w.r.to τj and

τj is s**g - regular w.r.to τi.

Remark A pairwise s**g - regular space need not be a pairwise s**g - T1 space as seen by next example.

Example Let X = {a, b, c}, τ1 = { , X, {a}}, τ2 = { , X, {b, c}}. Clearly the bitopological space (X, τ1, τ2) is pairwise s**g - regular but not a pairwise s**g - T1 space. Since {b} is not τ2 - s**g - closed.

Definition X is pairwise s**g - T3 if it is pairwise s**g - regular and pairwise s**g - T1.

Remark Pairwise s**g - T3 Pairwise s**g - T2.

Theorem Every pairwise s**g - T0, pairwise s**g - regular space is pairwise s**g - T1 and hence pairwise s**g - T3.

Example Let X be a pairwise s**g - T3 space. Then X is also a pairwise

s**g - T2 space. Let a, b X. Since X is a pairwise s**g - T1 space, {a} is a τj -

s**g - closed set. Since a and b are distinct. By pairwise s**g - regularity,

τi- s**g - open set U and a τj - s**g - open set V such that {a} U and b V.

Hence X is pairwise s**g - T3.

Definition A bitopological space X is called pairwise s**g - Urysohn**,** if for any two points x and y of X such that x ≠ y, there exists a τi - s**g - open set U and a τj - s**g - open set V such that x U, y V, τj - s**g - cl(U) τi - s**g - cl(V) = where i, j = 1, 2 and i ≠ j.

Example Let X = {a, b, c}, τ1 = { , X, {a}} and τ2 = { , X, {a}, {b, c}}.

It is clear that τi - s**g - open set , X, {a, c}, {c} and τj - s**g - open sets are

, X, {b, c}, {a}. Then the bitopological space X is called pairwise s**g -

Urysohn.

Remark Obviously, pairwise s**g - T3 pairwise s**g – Urysohn
pairwise s**g - T2.

Definition X is said to be pairwise s**g - normal if for each τi- s**g -

closed set A and τj- s**g - closed set B with A B = , there exists a τi - s**g

open set V B and there exists a τj- s**g - open set U A such that U V = , where i, j = 1, 2 and i ≠ j.

Example Let X = {a, b, c}, τ1 = τ2 = { , X, {a}, {b}, {a, b}}. Clearly the bitopological space (X, τ1, τ2) is pairwise normal but not pairwise s**g - normal as well as pairwise s**g - regular.

Definition A pairwise s**g - normal, pairwise s**g - T1 space is called pairwise s**g - T_4 space.

Example Let X be a pairwise s**g - T4 space. Then X is also a pairwise

s**g - T3 space. Suppose that F is a τj - s**g -closed subset of X and p X

does not belong to F. Since X is a pairwise s**g - T1 space, {p} is a τj - s**g -

closed set. Since F and {p} are disjoint. By pairwise s**g - normality, τi -

s**g - open set G and a τj - s**g - open set H such that F G and p {p} H.

Hence X is pairwise s**g - T4.

Definition A bitopological space X is said to be a pairwise s**g - completely normal provided that whenever A and B are subsets of X such that

τi - s**g - cl(A) B = and A τj - s**g - cl(B) = there exists a j - s**g -

open set U and a i - s**g - open set V such that A U, B V, U V = ,

where i, j = 1, 2 and i ≠ j.

Definition A pairwise s**g - T1 space, pairwise s**g -completely normal bitopological space is called pairwise s**g - T_5 space.

Theorem Every pairwise s**g - completely normal space is pairwise s**g -normal.

Proof. Let X be a pairwise s**g - completely normal bitopological space. Let

A be a i - s**g - closed set and B be a j - s**g - closed set such that A B =

. Then τi - s**g - cl(A) B = A B = and A τj - s**g - cl(B) = A B =

. By complete s**g - normality, there exists a j - s**g - open set u and a i -

s**g - open set V such that A U, B V, U V = . Hence X is pairwise s**g - normal.

Theorem Every pairwise completely normal space is pairwise s**g - completely normal.

Proof. The proof is obvious.

Theorem If a bitopological space (X, 1, 2) is pairwise s**g - completely

normal then every subspace is pairwise s**g - normal.

Proof. Let (X, 1, 2) be pairwise s**g - completely normal and (Y, 1y, 2y) be

a subspace. Let F1 and F2 be disjoint s**g - closed in 1y and 2y respectively.

F1y is 1 - s**g - closed F = 1y - s**gcl (F1). Then F1 2 - s**gcl (F2) = 1y

s**gcl (F1)2 - s**gcl (F2) = (Y1 - s**g - cl (F1))2 - s**gcl (F2) = 2y

s**gcl (F2) 1y - s**gcl (F1) = F1 F2 = . Similarly we can show that, 1 - s**gcl (F1) F2 = . Thus F1, F2 is a pairwise s**g - separated pair of X. By pairwise s**g - complete normality, there exists disjoint sets G1 1 and G2 2 such that, F2 G1, F1 G2. Then F2 Y G1, F1 Y G2, (Y G1) (Y G2) = and Y G1 1y,Y G2 2y. Hence (Y 1y, 2y) is pairwise s**g - normal.

Definition A subset A of a space (X, 1, 2) is said to be bi - s**g - open if it is both i - s**g open and j - s**g open, where i, j = 1, 2 and $i \neq j$.

Theorem Every pairwise s**g - closed, pairwise s**g - continuous image of a pairwise s**g - normal space is pairwise s**g - normal. on to
Proof. Let (X, 1, 2) be a pairwise s**g - normal space. Let f :(X, 1, 2) →

(Y, τ_1^*, τ^*_2) be a pairwise s**g - closed, pairwise s**g - continuous mapping. Let A and B be two disjoint subsets of Y, where A is τ_1^*- s**g - closed and B is

τ^*_2 - s**g - closed. Then $f^{-1}(A)$ is τ1- s**g - closed and $f^{-1}(B)$ is τ2 - s**g - closed. Also A B = $f^{-1}(A \cap B)$ = f^{-1}( ) = . Since X is pairwise s**g
- normal, there exists disjoint sets GA and GB such that $f^{-1}(A)$ GA, $f^{-1}(B)$
GB, where GA is τ2 - s**g - open and GB is τ1 - s**g - open. Let G_A^* = {y :$f^{-1}(y)$
GA} and G_B^* = {y : $f^{-1}(y)$ GB}. Then G_A^* G_B^*= , A G_A^*, B G_B^* and since
G_A^* = Y – f (X – GA), G_B^* = Y – f (X – GB). Here G_A^* is τ^*_2 - s**g - open and G_B^*
is τ_1^* - s**g - open. Hence (Y, τ_1^*, τ^*_2) is pairwise s**g - normal.

Theorem Every bi - s**g - closed subspace of a pairwise s**g -normal space is pairwise s**g - normal.

Proof. Let (Y, 1y, 2y) be a bi - s**g closed subspace of a pairwise s**g - normal

space (X, 1, 2). Let A be a iy - s**g - closed set and B be a jy - s**g - closed

set disjoint from A. Since the space Y is bi - s**g- closed, A is i - s**g closed

and j - s**g - closed, where i, j = 1, 2 and $i \neq j$. By pairwise s**g - normality

of (X, 1, 2), there exists a j - s**g - open set U and a i - s**g - open set V

such that A U, B V, U V = . Thus, A = A Y Y U and B = B Y

V Y.(U Y) (V Y) = . Also, U Y is jy- s**g - open and V Y is iy- s**g - open. Thus, there exists aiy- s**g - open set V Y and a jy- s**g - open set U Y such that A (U Y), B (V Y), (U Y) (V

= . Hence (Y, 1y, 2y) is pairwise s**g - normal.

REFERENCES :-

[1]. Arya S. P.. Gupta R. (1974). On Strongly continuous function, Kyunkpooka Math. J.. 14: 131-143.
[2]. R. Engelking, General topology of sigma series in Pure mathematics 1989 vol 6.
[3]. C. Janaki and Renu Thomas, R*-closed maps and R*-open maps in topological spaces, Global Research Analysis Vol.2, issue 6, June 2013, 162-164.

[4]. C. Janaki and Renu Thomas, On (1,2)* R* closed sets, Asian Journal of Current Engineering and Mathematics, Vol. 1, issue 6, 7 oct 2013.
[5]. J.C Kelly, Bitopological spaces, Proc. London Math. Soc. 13 (1963), 71-89. N. Levine, Semi-open sets and semi-continuity in topological spaces.
[6]. Amer Math. Monthly 70 (1963), 36-41.
[7]. N. Levine, Generalized closed sets in topology, Rend. Circ. Mat. Palermo, 19(2) (1970). 89-96.
[8]. Palaniappan N. and Rao K. C. (1993) Regular Generalized Closed Sets, Kyunkpooka Math. J., 33: (2), 211-219.
[9]. Sanjay Mishra, On Regular Generalized Weakly closed sets in topological spaces, International Journal of Math Analysis. Vol. 6, (2012), No.39, 1939- 1952.
[10]. M.Stone, Application of the Boolean rings to general topology, Trans. Amer.Math.Soc.41(1937).
[11]. Mahdi, Y.K., (2007), Semi-Open and Semi-Closed Sets in Bitopological Spaces, Accepted in The First Science Conference of Education College, Babylon Unive, February 18-19.
[12]. Kelly.j.c, (1963), Bitopological Spaces, London Math. Soc., Vol. 13, 71-89.
[13]. Lellis Thivagav, M. and B.Meera.Devi, (2010), Bitopological B-Open Sets, International Journal of Algorithms, Computing and Math, Vol. 3, No. 3
[14]. Lellis Thivagav, M., (1991), Generalization of Pairwise a-Continuous Functions, Pure and Appl. Mathematica sci, Vol.28, 55-63.