Annals of Pure and Applied Mathematics
Vol. 16, No. 1, 2018, 21-30
ISSN: 2279-087X (P), 2279-0888(online)
Published on 1 January 2018
www.researchmathsci.org
DOI: http://dx.doi.org/10.22457/apam.v16n1a3

Annals of
Pure and Applied Mathematics

On Decompositions of (r*g*)* Closed Set in Topological Spaces

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Received 20 November 17; accepted 10 December 2017

Abstract. The aim of this paper is to obtain decompositions of (r*g*)* closed set. The concept of (r*g*)* locally closed sets and (r*g*)* locally continuous functions are introduced and some of their properties are investigated. Furthermore the notions of P* sets, P** sets, Q** sets, W* sets and A* sets are introduced and are used to obtain the decompositions of (r*g*)* closed sets.

Keywords: (r*g*)* closed set, (r*g*)* closure, (r*g*)* continuous functions, (r*g*)* irresolute functions, (r*g*)* open sets.

AMS Mathematics Subject Classification (2010): 54A05

1. Introduction

Levin [10] introduced the concept of generalized closed set in topological spaces. The concept of locally closed sets in a topological space was introduced by Bourbaki [4]. Ganster and Reilly [5] further studied the properties of locally closed sets and defined the LC–continuity and LC-irresoluteness. Balachandran et al. [3] introduced the concept of generalized locally closed sets and GLC – continuous functions and investigated some of their properties. Arockiarani, Balachandran and Ganster [2] introduced regular generalized locally closed sets and RGL- continuous functions. The Authors [12] have already introduced (r*g*)* closed sets and investigated some of their properties. The aim of this paper is to introduce (r*g*)* locally closed set and (r*g*)* locally continuous function and investigate some of their properties. Furthermore the notions of P* sets, P** sets, Q** sets, W* sets and A* sets are used to obtain the decompositions of (r*g*)* closed sets.

2. Preliminaries

Definition 2.1. A subset A of a Topological space X is called

1) A generalized closed set (g-closed) [10] if cl(A)$\subseteq$ U whenever A$\subseteq$ U and U is open.

2) A regular generalized closed set (rg-closed) [10] if cl(A) ⊆U whenever A⊆U and U is regular open.
3) A(r*g*)* closed set [12] if cl(A) ⊆U whenever A⊆U and U is r*g*- open. The complement of (r*g*)* closed set is (r*g*)* open.
4) A locally closed set [5] if A = S ⋂ F where S is open and F is closed.
5) A generalized locally closed set [3] if A = S ⋂ F where S is g-open and F is g-closed.
6) A glc*-set [3] if A = S ⋂ F where S is g-open and F is closed.
7) A glc**-set [3] if A = S ⋂ F where S is open and F is g- closed.
8) A regular generalized locally closed set [2] is S = G ⋂ F where G is rg-open and F is rg-closed in (X, ℑ) .
9) A rglc* [2] if there exists a rg-open set G and a closed set F of (X,ℑ) such that S=G ⋂ F.
10) A rglc**[2] if there exists an open set G and a rg-closed set F such that B = G ⋂ F.

Definition 2.2. A subset S of a topological space is called a
1. t set [17] if int(S)=int(cl(S)).
2. t*set [7] if cl(S)= cl(int(S)).
3. α* set if [15] int(S)=int(cl(int(S))).
4. C set [16] if S= G ⋂ F where G is open and F is a t set.
5. Cr set [16] if S=L ⋂ M where L is rg open and M is a t set.
6. Cr*set [16] if S=L ⋂ M where L is rg open and M is a α* set.
7. A set if [18] S= G⋂ F where G is open and F is a regular closed set.

Definition 2.3. Let X be a Topological space. Let A be a subset of X. (r*g*)* closure [14] of A is defined as the intersection of all (r*g*)* closed sets containing A.

Definition 2.3. A function f : (X,ℑ) → (Y, σ) is called
(i) g- continuous [10] if $f^{-1}(V)$ is g closed in (X,ℑ) for every closed set V of (Y,σ).
(ii) (r*g*)*-continuous [13] if the inverse image of every closed set in (Y, σ) is (r*g*)*-closed in (X,ℑ)
(iii) (r*g*)*-irresolute map [13] if $f^{-1}(V)$ is a (r*g*)*-closed set in (X,ℑ) for every (r*g*)* closed set V of (Y, σ).
(iv) LC-continuous [5] if $f^{-1}(V)$ is a locally closed set in (X,ℑ) for every open set V of (Y, σ).
(v) G LC-continuous [3] if $f^{-1}(V)$ is a gl-closed set in (X,ℑ) for every open V of (Y, σ).
(vi) Rgl continuous [2] if $f^{-1}(V)$ is a rgl closed set in (X,ℑ) for every open V of (Y,σ).

3. (r*g*)* locally closed sets

Definition 3.1. A Subset S of (X,ℑ) is called (r*g*)* Locally closed if S = A ⋂ B where A is (r*g*)* open and B is (r*g*)* closed.

Example 3.2. Let X = { a, b, c}. Let ℑ = (φ ,X,{a},{b},{a,b}}.

Closed sets are **{**φ X, {c},{b,c},{a,c}}
(r*g*)* closed sets are { φ, X, {c},{b,c},{a,c}}
(r*g*)* open sets are { φ , X, {a,b} {a},{b}}
Now {a} = {a,b} ∩ {a,c} where {a,b} is (r*g*)*open and {a,c} (r*g*)* closed and hence {a} is a (r*g*)*locally closed set.
Here {a},{b},{c},{a,b},{b,c},{a,c} are (r*g*)* Locally closed sets.

Definition 3.3. A Subset S of (X, ℑ) is called (r*g*)* Locally * closed if S = A ∩ B where A is (r*g*)* open and B is closed.

Example 3.4. In Example 3.2 {b}={a,b}∩ {b,c} is (r*g*)* Locally * closed.

Definition 3.5. A subset S of (X, ℑ) is called (r*g*)* locally** closed if S = A ∩B where A is open and B is (r*g*)* closed.

Example 3.6. In Example 3.2 {a}={a,b}∩ {a,c} is (r*g*)* locally **closed.

Remark 3.7. Every closed set is (r*g*)* locally closed set.

Theorem 3.8.
(i) Every Locally closed sets is (r*g*)* locally closed.
(ii) Every g* locally closed set is (r*g*)* locally closed
(iii) Every (r*g*)* locally closed set is gpr locally closed
(iv) Every (r*g*)* locally closed set is rwg locally closed
(v) Every (r*g*)* locally closed set is rg locally closed

Proof:
(i) Let S=A ∩ B where A is open and B is closed in X. But every open set is (r*g*)*open and every closed set is (r*g*)*closed and hence S is (r*g*)*locally closed set.
(ii) Proof follows from the fact that every g* closed set is (r*g*)* closed set [12].
(iii) Proof follows from the fact that every (r*g*)* closed set is gpr closed set [12].
(iv) Proof follows from the fact that every (r*g*)*closed set is rwg closed set [12].
(v) Proof follows from the fact that every (r*g*)* closed set is rg closed set [12].
The converse of the above statements need not true as seen from the following example.

Example 3.9.
(i) Let X = { a, b, c}. Let ℑ = {φ ,X ,{c},{b,c}}
Closed sets are **{** φ, X, {a},{a,b}}
(r*g*)* closed sets are { φ, X, {a},{a,b},{a,c}}
(r*g*)* open sets are { φ , X, {b,c}{c},{b}}
Here {a,c} is (r*g*)*locally closed set but not locally closed set.

(ii) Let X={a,b,c} , ℑ = {φ ,X ,{a}}
Closed sets are { φ,X,{a}}
Here {b} is not a g* locally closed set but it is a (r*g*)* closed set.
(iii) let X={a,b,c,d}, ℑ = (φ ,X ,{a},{a,c},{a,d},{a,c,d}}
Closed sets are { φ, X,{b,c,d},{b,d},{b,c},{b}}
Here {c,d} is gpr closed set but not (r*g*)* closed set.
(iv) In the above example {a,c,d} is rwg closed set but not (r*g*)* closed set.
(v) In the above example {c,d} is rg closed set but not (r*g*)* closed set.

Remark 3.10.
(r*g*)* locally closed sets are independent of semilocally closed sets, α locally closed sets, wg locally closed setsand the following examples support our statement.

Example 3.11.
Let X = {a,b,c,d} ,ℑ = { φ, X, {a,b} {c,d} }. Here {a} is (r*g*)* locally closed but not semi locally closed set.
Let X={a,b,c,d}, ℑ = { φ, X, {a},{a,c},{a,d},{a,c,d}. Here {c,d} is semi locally closed set but not (r*g*)* locally closed set.

Example 3.12. Let X = {a,b,c,d}, ℑ = { φ, X, {a,c}, {a,d} {a} , {a,c,d} }
Here {a,c} in not α locally closed set but {a,c} is (r*g*)* locally closed set
Here {c,d} is α locally closed set but {c,d} is not (r*g*)* locally closed.

Example 3.13. From the above example, {c,d} is wg locally closed set but {c,d} is not (r*g*)* locally closed set.
Let X={a,b,c,d}, ℑ = { φ, X,{a,b,c},{a,c,d},{a,c},{a},{c}}. Here {a,d} is (r*g*)* closed set but not wg locally closed set.

Theorem 3.14. Every locally closed set is (r*g*)* locally* closed.
The converse need not be true as seen from the following example.

Example 3.15. In example 3.8 {a,c} is (r*g*)*locally*closed but not locally closed.

Theorem 3.16. Every locally closed set is (r*g*)* locally** closed.
The converse need not be true as seen from the following example.
In example 3.9 {a,c} is (r*g*)*locally**closed but not locally closed.

Theorem 3.17. If A is (r*g*)* locally closed in X and B is (r*g*)* open then A ∩B is (r*g*)* locally closed in X**.**
Proof: Since A is (r*g*)* locally closed A=P ∩ Q where P is (r*g*)*Closed and Q is (r*g*)* open. Now A ∩ B = (P ∩ Q)∩ B =P ∩ (Q ∩ B).
Since (Q ∩ B) is (r*g*)* open and P is (r*g*)* closed A ∩ B is (r*g*)* locally closed.

Theorem 3.18. A subset S of (X, $\Im$) is (r*g*)* Locally closed (X – S) is the union of a (r*g*)* open and a (r*g*)* closed set.
Proof: If S is (r*g*)* locally closed then S = P ∩ Q where P is (r*g*)* closed And Q is (r*g*)* open . Now X - S = X - (P ∩ Q) = $(P \cap Q)^c$ = $P^c \cup Q^c$
Now P^c is (r*g*)* open& Q^c is (r*g*)* closed. Hence the result.

Result 3.19. The complement of a (r*g*)* locally closed set need not be locally closed.

Example 3.20. Let X = {a,b,c}, $\Im$ = { φ, X, {c}, {b,c}.
Closed sets are { φ, X, {a,b}, {a}}
Here {b} is (r*g*)* locally closed .But its complement {a,c} is not locally closed.

Theorem 3.21. Let A and B are subsets of (X, $\Im$). If A is (r*g*)*locally**closed and B is open then A ∩ B is (r*g*)*locally**closed.
Proof: Let A be (r*g*)*locally**closed in (X, $\Im$).Then there exists an open set P and (r*g*)*closed set Q such that A=P ∩ Q. Now
A ∩ B = (P ∩ Q)∩B= (P ∩ B) ∩ Q which is (r*g*)*locally**closed set.

Theorem 3.22. If A is (r*g*)*locally* closed subset of (X, $\Im$) and B is (r*g*)* closed then A ∩ B is (r*g*)* locally closed.
Proof: Let A be (r*g*)*locally* closed. Then A=P ∩ Q where P is (r*g*)* open and Q is closed. Now A ∩ B = (P ∩ Q) ∩ B=P ∩(B ∩ Q). Hence A ∩ B is (r*g*)* locally closed.

Theorem 3.23. If A is (r*g*)*locally*closed subset of (X,$\Im$) and B is (r*g*)*open then A ∩ B is (r*g*)*locally closed.
Proof: Let A be (r*g*)*locally closed. Then A=P ∩ Q where P is (r*g*)*open and Q is (r*g*)*closed. Now A ∩ B = (P ∩ Q) ∩ B=(P ∩ B) ∩ Q. Hence A ∩ B is (r*g*)*locally closed.

4. (r*g*)* locally continuous functions
Definition 4.1. A function f :(X,$\Im$)→ (Y, σ) is called (r*g*)* locally continuous ,if $f^{-1}(V)$ is (r*g*)*locally closed in (X,$\Im$) for every open set V in (Y,σ).

Example 4.2. Let X = {a,b,c} and $\Im$ = { X , φ, {c},{b,c}}.
Closed sets are {X ,φ, { a,b} {a}}. (r*g*)*Closed sets are {X ,φ, {a} { a,b} {a,c}}. (r*g*)*open sets are {X ,φ, {b,c} {c},{b}}.
(r*g*)*locally closed set are {X ,φ, {a},{ a,b},{a,c}, {b,c} {c},{b}}.
Let Y ={a,b,c} σ= {Y, φ, {b}}
Define f : (X, $\Im$) → (Y, σ) defined by f(a) =a, f(b)=c f(c)=b.
Now {b} ∈ σ and $f^{-1}(\{b\})$ = {c} which is(r*g*)*locally closed in(X, $\Im$).
Hence f is (r*g*)*locally continuous function.

Definition 4.3. A function f (X,$\Im$) $\rightarrow$ (Y, σ) is said to be a (r*g*)* locally irresolute function if $f^{-1}(V)$ is a (r*g*)* locallyclosed set in (X,$\Im$) for every (r*g*)* locally closed set V of (Y, σ).

Example 4.4. Let X={a,b,c} $\Im$ = {φ ,X, {a}}. Closed sets = { ϕ,X, {b,c}}
(r*g*)* closed sets are { ϕ,X,{b},{a,b} {c},{b,c},{a,c} }
(r*g*)*open sets are { ϕ,X ,{a},{b}{a,b} {c},{a,c} }
(r*g*)*locally closed sets are { ϕ,X, {a},{b}{a,b} {c},{b,c},{a,c} }
Y={a,b,c},σ = { ϕ,X, {a},{b},{a,b}}. Closed set of Y = { ϕ,X, {b,c},{a,c},{c}}
(r*g*)* closed set of Y are { ϕ,Y, {c},{b,c},{a,c} }
(r*g*)*open sets of Y are { ϕ,Y, {a},{b},{a,b}}
(r*g*)*locally closed sets are { ϕ,Y, {a}{b}{a,b} {c},{b,c},{a,c}}
Here Let f : (X,$\Im$) → (Y, σ) be defined by f(c)=c,f(b)=a,f(a)=b
f^{-1}({a})={b}, f^{-1}(b)={a}, $f^{-1(}${c})={c} f^{-1}({a,b})={a,b}, f^{-1}({b,c})={a,c}, f^{-1}({a,c})={b,c} which are (r*g*)* locally closed in (X,$\Im$). Hence f is a (r*g*)*locally closed irresolute map.

Theorem 4.5. Every locally continuous function is (r*g*)* locally continuous.
Proof: Let f : (X,$\Im$)→ (Y, σ) be a locally continuous map. Let F be an open set in (Y, σ)**.** Then$f^{-1}(F)$ is locally closed in (X,$\Im$). Since every locally closed set is (r*g*)*locally closed, $f^{-1}(F)$ is (r*g*)*locally-closed set. Therefore f is (r*g*)* locally continuous.
The converse need not be true as seen from the following example.

Example 4.6. Let X ={a,b,c} $\Im$ = { ϕ,X, {c},{b,c}}.
Closed set of X = { ϕ,X,{a,b},{a}}
Locally closed sets are {φ,X.{a},{c}{a,b},{a,c}}
(r*g*)* closed sets are { ϕ,X, {a},{a,b},{a,c}
(r*g*)*open sets are{ φ,X,{b,c}, {c}, {b}}
(r*g*)*locally closed sets are{ ϕ,X, {a},{b}{a,b} {c},{b,c},{a,c} }
Let Y ={a,b,c}, σ = { ϕ,Y, {b}}. Closed set of Y = { ϕ,Y,{a,c}}
Locally closed sets are{ φ,Y,{b},{a,c}. Define f by f(c)=a ,f(b)=b,f(a)=c.
Now {b} is open in (Y, σ).f^{-1}{b}={b} which is(r*g*)* locally closed set. Therefore f is (r*g*)* locally continuous. But f^{-1}{b}={b} is not locally closed in (X, $\Im$). Hence f is not locally continuous.
Similarly we can prove the following results.

Theorem 4.7.
(i) Every g* locally continuous function is (r*g*)* locally continuous.
(ii) Every (r*g*)* locally continuous function set is gpr locally continuous function
(iii) Every (r*g*)* locally continuous function set is rwg locally continuous function
(iv) Every (r*g*)* locally continuous function set is rg locally continuous function.

Definition 4.8. A function f :(X,$\Im$) →(Y, σ) is called (r*g*)*locally *continuous, if f^{-1} (V) is (r*g*)*locally* closed in (X, $\Im$) for every V∈ σ.

Example 4.9. In example 4.6 the function f is (r*g*)*locally*continuous function.

Definition 4.10. A map f : (X, $\Im$) → (Y, σ) is said to be a (r*g*)* locally* irresolute map if $f^{-1}(V)$ is a (r*g*)* locally*closed set in (X,$\Im$) for every (r*g*)* locally*closed set V of (Y, σ) .

Example 4.11. In example 4.4 f is (r*g*)*locally*irresolute.

Definition 4.12. A function f :(X, $\Im$) → (Y, σ) is (r*g*)*locally ** continuous, if f^{-1} (V) is (r*g*)*locally** closed in (X,$\Im$) for every V open in (Y, σ).

In example 4.6 the function f is (r*g*)*locally**closed continuous

Definition 4.13. A function f : (X, $\Im$) → (Y, σ) is said to be a (r*g*)* locally**irresolute function if $f^{-1}(V)$ is a (r*g*)* locally**closed set in (X, $\Im$) for every(r*g*)* locally**closed set V of (Y, σ).

Example 4.14. The function f defined in example 4.4 is a (r*g*)* locally** irresolute.

Theorem 4.15. Let f : (X, $\Im$) → (Y, σ) be a function. If f is locally continuous, then it is (r*g*)* locally*continuous and (r*g*)*locally**continuous.

Proof: Let f: (X,$\Im$) → (Y, σ) be a locally continuous function. Let F ∈ σ**.** Then$f^{-1}(F)$ is locally closed in (X, $\Im$). Since every locally closed set is (r*g*)*locally*closed, $f^{-1}(F)$ is (r*g*)*locally* closed set. Therefore f is (r*g*)*locally*continuous. Also since every locally closed set is (r*g*)*locally**closed, $f^{-1}(F)$is (r*g*)*locally**closed set. Hence f is (r*g*)*locally **continuous.

The converse need not be true as seen from the following example.

Example 4.16. Let X = {a,b,c} and $\Im$ = { X , φ, {c},{b,c}}.

Closed sets are{X ,φ, { a,b}, {a}}

Locally closed sets of X are{ X ,φ, {b},{a,c}}.

(r*g*)*Closed sets of X are {X ,φ, {a} { a,b} {a,c}}

(r*g*)*open sets of X are {X ,φ, {b,c} {c},{b}}

(r*g*)*locally closed set of X are {X ,φ, {a},{ a,b},{a,c}, {b,c} {c},{b}}

(r*g*)*locally* closed set of X are {X ,φ, {a},{ a,b}, {b,c} {c},{b}}

(r*g*)*locally** closed set of X are {X ,φ, {a},{ a,b},{a,c}, {b,c}, {c}}

Let Y = {a,b,c}, σ = { ϕ,Y, {a}} Closed set = { ϕ,Y, {b,c}}

Define a mapping f: (X, $\Im$) → (Y, σ) by f(a)=a, f (b)=c, f (c)=b.

Here f^{-1}{a}={a} is (r*g*)*locally*closed and (r*g*)*locally**closed but not a locally closed set. Hence f is (r*g*)*locally*closed continuous and (r*g*)*locally**continuous but not locally continuous.

Theorem 4.17. Let f : (X, $\Im$) → (Y, σ) be a function. If f is (r*g*)* locally* continuous, then it is (r*g*)* locally continuous.

Proof: Let f be (r*g*)* locally*continuous. Let V∈ σ. Then f^{-1}(V) is (r*g*)*locally*closed .∴ $f^{-1}(V) = F \cap G$ where F is (r*g*)* open and G is closed. But every closed set is (r*g*)*closed.∴ G is (r*g*)*closed and.

∴ f^{-1}(V) is (r*g*)*locally closed . Hence f is (r*g*)*locally continuous.

The converse need not be true as seen from the following example.

Example 4.18. In example 4.16Let Y = {a,b,c}, σ = { ϕ,Y, {b,c}}.
Closed set = { ϕ,Y, {a}}Define f by f(a)=b , f (c)=c f (b) =a .
f^{-1}\{b,c\}={a,c} is (r*g*)*locally closed and hence f is (r*g*)*locally continuous but f^{-1}\{b,c\}={a,c} is not (r*g*)*locally*closed. Therefore f is not (r*g*)* locally* continuous .
Similarly, we can prove the following theorem.

Theorem 4.19. Let f : (X, $\Im$) → (Y, σ) be a map. If f is (r*g*)* locally** continuous, then it is (r*g*)* locally continuous.
The converse need not be true as seen from the following example.
In example 4.16 let Y = {a,b,c}, σ = { ϕ,Y, {b,}}. Closed set = { ϕ,Y, {a c}} define f by f(b)=b, f (c)=a, f (a) =c. Now f^{-1}\{b\}={b} is (r*g*)*locally closed and hence f is (r*g*)* locally continuous. But f^{-1}\{b\}={b} is not (r*g*)* locally** closed in X. Therefore f is not (r*g*)*locally** continuous.

Theorem 4.20. Let f : (X, $\Im$) → (Y, σ) be a map. If f is (r*g*)* locally* irresolute, then it is (r*g*)* locally continuous.

Proof: Let V∈ σ. Then V=V ⋂Y. Hence V is (r*g*)*locally closed in Y. Since f is (r*g*)* locally*irresolute, f^{-1}(V) is (r*g*)* locally*closed. Now $f^{-1}(V) = F \cap G$, where F is (r*g*)* open and G is closed. But every closed set is (r*g*)*closed ∴ f^{-1}(V) is (r*g*) locally closed. Hence f is (r*g*)*locally continuous.

The converse need not be true as seen from the following example.
In example 4.16, let Y = {a,b,c}, σ = { ϕ,Y, {a,b}}. Closed set = { ϕ,Y, {c}}. Let f be defined by f(a)=a, f (c)=b, f (b) = c. Now f^{-1}\{a,b\}={a,c} is (r*g*)*locally closed but not (r*g*)*locally*closed. Hence f is (r*g*)*locally continuous but not (r*g*)*locally* irresolute.

Remark 4.21. Composition of two (r*g*)* locally continuous function need not be (r*g*)* locally continuous.
Let X=Y={a,b,c,d}.
Let f : (X, $\Im$) → (Y , σ) where $\Im$={φ, X ,{a,c}, {a,d}, {a}, {a,c,d}}.
σ = { φ,X,{a,b},{c,d}}.
Let f be defined by f(a) = a, f(d) = c, f(c)= b, f(b) = d
f^{-1} (a,b) = {a,c} , f^{-1} (c,d) = {d,b}
f^{-1} (a,b) is (r*g*)* locally closed. f^{-1} {(c,d)} is (r*g*)* locally closed. Hence

f : X → Y is (r*g*)* locally continuous
let g : (Y,σ) → (Z , η) where η = { φ,X, {a,b}} be defined by g (c) = b, g(a) =c, g(d) = d, g(b)=a.
g^{-1}({a,b})={b,c} is (r*g*)* locally closed and hence g is (r*g*)* locally continuous but (g o f)$^{-1}$ ({a,b}) = f^{-1} (g^{-1} ({a,b}) = f^{-1} ({b,c}) ={c,d} is not (r*g*)* locally closed. Hence g o f is not (r*g*)* locally continuous.
The following theorem gives the condition under which the composition of two functions is (r*g*)*locally continuous.

Theorem 4.22. Let f : (X, $\mathfrak{I}$) → (Y, σ) and g : (Y, σ) → (Z, η) be two function. Then

1) gof is (r*g*)*locally continuous if g is(r*g*)*locally continuous and f is (r*g*)* locally irresolute
2) gof is (r*g*)*locally irresolute if both f and g are (r*g*)*locally irresolute.
3) gof is (r*g*)* locally* continuous if g is (r*g*)* locally* continuous and f is (r*g*)*locally*irresolute.

5. Another decomposition of (r*g*)* closed sets

The following definitions are introduced to obtain decompositions of (r*g*)*closed set.

Definitions 5.1. A subset A of a topological space X is called a

1) P*set if A=L ∩ M where L is (r*g*)* open and M is a t set.
2) P** set if A=L ∩ M where L is (r*g*)* open and M is a t* set.
3) Q** set if A=L ∩ M where L is (r*g*)* open and M is a C set.
4) W* set if A=L ∩ M where L is (r*g*)* open and M is an α* set.
5) A* set if A=L ∩ M where L is (r*g*)* open and M is a regular closed set.

Propositions 5.2.

1. Every C set is a P* set
1) Every P* set is Cr set.
2) Every W* set is Cr*set.
3) Every A set is A*set.
4) Every A* set is P**set.
5) Every t set is P *set.
6) Every C set is Q**set.
7) Every α* set is W* set.
8) Every (r*g*)* open set is P* set.
9) Every (r*g*)* open set is W* set.

Remark 5.3. The converses need not be true as seen from the following examples.

Example 1. Let X={a,b,c} $\mathfrak{I}$={∅,X, {a},{b,c}.
Here {b} is P* but not C.

Example 2. Let X={a,b,c} $\mathfrak{I}$={∅,X ,{b},{a,b}}.
Here {b,c} is a Cr set but not a P* set.

Example 3. In example 2 {b,c} is Cr* but not W*.

Example 4. In example 2 {b,c} is P** but not A*.

Example 5. In example 2 {a} is A* but not A.

Example 6. In example 2 {a,b} is P* but not t

Example 7. In example 1 {a,b} is Q** but not C.
Example 8. In example 2 {b} is w* but not α*
Example 9. In example 2 {c} is P* but not (r*g*)*open.
Example 10. In example 2 {a,c} is W* but not (r*g*)*open.

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