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On ℳ*icro* α- generalized closed and ℳ*icro semi*- generalized closed in ℳ*icro* -topological spaces

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ABSTRACT

We're going to study a new definitions in this paper that's are ℳicro α − generalized closed , ℳicro generalized α − closed, ℳicro generalized ꞩemi − closed and ℳicro ꞩemi − generalized closed. Also, we show the relationships between them in illustration diagram and gives some results and examples.

1. Introduction

One of an essential object in a topological space called closed sets so by using the 'Kuratowski closure axioms' or the axioms of it one can present the topology on sets. N. Levine[1], in (1970), introduce an important definition that provides for, A subset ß of (Ꭓ, 𝔉) is named generalized closed if $Cl.$(ß) ⊆ Ʉ whenever ß ⊆ Ʉ for all Ʉ is open, P. Bhattacharya and B.K. Lahiri [2], in 1987 present semi-generalized closed sets in topology and in 1995 J. Dontchev [3] study the On generating ꞩemi -preopen sets. And it follows in 2002, J.Cao, M. Ganster and I. Reilly [4] described on generalized closed sets. Lellis Thivagar [5] given the concept of Ŋ*ano*-topology in 2013. Also, the authors Bhuvaneswari, Ezhilarasi [6] and Thanga Nachiyar [7] introduced on Ŋ*ano* genaeralized ꞩemi closed sets and Ŋ*ano* ꞩemi - generalized, on Ŋ*ano* A-generalized closed sets and Ŋ*ano* generalized A-closed sets in the spaces of Ŋ*ano*-topology, resp. in 2014. Many authors [8,9] study on Ŋ*ano* Topology and ℳicro topological spaces. Recently in 2020 the topic of Micro-α-open sets and Micro-α- continuous functions in ℳicro topological spaces was given by Jasim and Rasheed [10]. This prompts us to continue to develop and generalize this topic by presenting some important definitions such as ℳicro α − generalized closed , ℳicro generalized α − closed, ℳicro generalized ꞩemi − closed and ℳicro ꞩemi − generalized closed and noting some results on them in a diagram and gives some examples.

2. Preliminaries

In principle, we call some important basics and acquaintances.

Definition2.1[8]: Let Ꭓ a non empty finite set things called the universal and 𝔎 is the equivalence relation on Ꭓ named as the indiscernibility relation elements belonging to the same equivalence class are said to be indiscernible with one another. The pair (Ꭓ, 𝔎) is said to be approximation space. Let Ą ⊆ Ꭓ ,

1. The Lower approximation of Ą with respect to 𝔎 the set of all things, which can be for certain classified as Ą with respect to 𝔎 and is defined by $L_{𝔎}$(Ą)=$\cup_{x\in Ꭓ}$ {$𝔎(x)$: $𝔎(x)$ ⊆ Ą}, $Where$ $𝔎(x)$ denotes the equivalence class determined by x.

2. The upper approximation of Ą with respect to 𝔎 is these of all things, which can be possibly classified as X with respect to 𝔎 and is defined by $U_{𝔎}$(Ą) = $\cup_{x\in Ꭓ}${$𝔎(x)$: $𝔎(x)$ ∩ Ą ≠ ∅}.

3.The boundary region of X with respect to $R$is the set of all things, which can be classified neither as Ą nor as not Ą with respect to $\mathfrak{K}$ and is defined by $B_{\mathfrak{K}}(Ą) = U_{\mathfrak{K}}(Ą) - L_{\mathfrak{K}}(Ą)$.

Definition 2.2[8]: Let X be the universal, $\mathfrak{K}$ be an equivalence relation on X and $\mathfrak{F}_{\mathfrak{K}}(Ą) = \{X, \emptyset, L_{\mathfrak{K}}(Ą), U_{\mathfrak{K}}(Ą), B_{\mathfrak{K}}(Ą)\}$ where $Ą \subseteq X$. Then $\mathfrak{F}_{\mathfrak{K}}(Ą)$ satisfies The following axioms.

1. X *and* $\emptyset \in \mathfrak{F}_{\mathfrak{K}}(Ą)$.
2. The union of the elements of any sub collection of $\mathfrak{F}_{\mathfrak{K}}(Ą)$ is in $\mathfrak{F}_{\mathfrak{K}}(Ą)$.
3. The intersection of the elements of any finite sub collection of $\mathfrak{F}_{\mathfrak{K}}(Ą)$ is in $\mathfrak{F}_{\mathfrak{K}}(Ą)$.

That is $T_R(X)$ forms a topology on X called as Nano topology on X with respect to Ą. We call $(X, \mathfrak{F}_{\mathfrak{K}}(Ą))$ as the Nano topological space .The elements of $\mathfrak{F}_{\mathfrak{K}}(Ą)$ are called Nano open sets .

Definition2.3[9]: Let $(X, \mathfrak{F}_{\mathfrak{K}}(Ą))$ be *Nano*-topological space then

$\mu_{\mathfrak{K}}(Ą) = \{N_1 \cup (N_2 \cap \mu) : N_1, N_2 \in \mathfrak{F}_{\mathfrak{K}}(Ą)\}$ is called 'Micro-topology' of $\mathfrak{F}_{\mathfrak{K}}(Ą)$ by μ where $\mu \notin \mathfrak{F}_{\mathfrak{K}}(Ą)$.

Definition2.4[9]: A Micro -topology $\mu_{\mathfrak{K}}(Ą)$ satisfies the next axioms:

a) X and $\phi \in \mu_{\mathfrak{K}}(Ą)$.

b) The union of the elements of each sub-collection of $\mu_{\mathfrak{K}}(Ą)$ is in $\mu_{\mathfrak{K}}(Ą)$.

c) The intersection of the elements of each finite sub collection of $\mu_{\mathfrak{K}}(Ą)$ is in $\mu_{\mathfrak{K}}(Ą)$.

Then $\mu_{\mathfrak{K}}(Ą)$ is called Micro topology on X with respect to Ą. The tripartite $(X, \mathfrak{F}_{\mathfrak{K}}(Ą), \mu_{\mathfrak{K}}(Ą))$ is called 'Micro -topological space' and the elements of $\mu_{\mathfrak{K}}(Ą)$ are called 'Micro -open' sets and the complement of a 'Micro -open' set is called a 'Micro -closed' set.

Definition2.5[1]: A subset ß of $(X, \mathfrak{F})$ is called generalized closed (shortly g -closed) if $Cl.(ß) \subseteq Ʉ$ and for all $ß \subseteq Ʉ$ for all Ʉ is open in $(X, \mathfrak{F})$.

3. Micro α − GENERALIZED Closed AND Micro semi − GENERALIZED Closed Sets

Here in this section we will provide definitions and examples and some results obtained

Definition3.1[10]: The Micro-α-closure form a set ß of a Micro topological space $(X, \mathfrak{F}_{\mathfrak{K}}(Ą), \mu_{\mathfrak{K}}(Ą))$ is the intersection of all Micro-α-closed sets that contain ß and denoted by Mic. α − $Cl.(ß)$.

Definition3.2: A subset ß of a space $(X, \mathfrak{F}_{\mathfrak{K}}(Ą), \mu_{\mathfrak{K}}(Ą))$ is said to be Micro generalized α − closed (shortly Mic. gα − closed) if Mic. α − $Cl.(ß) \subseteq Ʉ$ and for all $ß \subseteq Ʉ$ for all Ʉ is Micro α − *open*. The complements of Micro generalized α − closed is called Micro generalized α − open.

Definition3.3: A subset ß of a space $(X, \mathfrak{F}_{\mathfrak{K}}(Ą), \mu_{\mathfrak{K}}(Ą))$ is said to be Micro α − generalized closed (shortly Mic.α g − closed) if Mic. α − $Cl.(ß) \subseteq Ʉ$ and for all $ß \subseteq Ʉ$ for all Ʉ is Micro *open*. The complements of Micro α −generalized closed is called Micro α −generalized open.

Example3.4: Let's we have the universe set $X = \{1,2,3,4\}$ with the equivalence relation $X/\mathfrak{K} = \{\{1\},\{3\},\{2,4\}\}$ and $Ą = \{2,4\}$ then the *Nano − topology* is $\mathfrak{F}_{\mathfrak{K}}(Ą) = \{\phi, X, \{2,4\}\}$. Let $\mu = \{2\}$,The Micro − topology is $\mu_{\mathfrak{K}}(Ą) = \{\phi, X, \{2\}, \{2,4\}\}$. Sets of closed Micro denoted $C\mu_{\mathfrak{K}}(Ą) = \{\phi, X, \{1,3,4\}, \{1,3\}\}$. We can deduce the collection of all Micro α-open as:

$\alpha O(X) = \{\phi, X, \{2\}, \{1,2\}, \{2,3\}, \{2,4\}, \{1,2,3\}, \{1,2,4\}, \{2,3,4\}\}$

And Micro α-closed as:

$M\alpha C(X) = \{\phi, X, \{1,3,4\}, \{3,4\}, \{1,4\}, \{1,3\}, \{4\}, \{3\}, \{1\}\}$

Now, we will take the sets of all power of X and we check which one of them are M. g. closed , M. αg. closed and M. gα. *closed* as in the table:

Table 1

P(X)	M. *Cl.* (Ą)	M. α*Cl.* (Ą)	M. g. closed	M. αg.	M. gα.
{1}	{1,3}	{1}	T	T	T
{2}	X	X	F	F	F
{3}	{1,3}	{3}	T	T	T
{4}	{1,3,4}	{4}	F	T	T
{1,2}	X	X	T	T	F
{1,3}	{1,3}	{1,3}	T	T	T
{1,4}	{1,3,4}	{1,4}	T	T	T
{2,3}	X	X	T	T	F
{2,4}	X	X	F	F	F
{3,4}	{1,3,4}	{3,4}	T	T	T
{1,2,3}	X	X	T	T	F
{1,2,4}	X	X	T	T	F
{1,3,4}	{1,3,4}	{1,3,4}	T	T	T
{2,3,4}	X	X	T	T	F
ϕ	ϕ	ϕ	T	T	T
X	X	X	T	T	T

Here we consider three collections:

The collection of

$MgC(X) = \{\phi, X, \{1\}, \{3\}, \{1,2\}, \{1,3\}, \{1,4\}, \{2,3\}, \{3,4\}, \{1,2,3\}, \{1,2,4\}, \{1,3,4\}, \{2,3,4\}\}$

The collection of

$M\alpha gC(X) = \{\phi, X, \{1\}, \{3\}, \{4\}, \{1,2\}, \{1,3\}, \{1,4\}, \{2,3\}, \{3,4\}, \{1,2,3\}, \{1,2,4\}, \{1,3,4\}, \{2,3,4\}\}$

The collection of

$Mg\alpha C(X) = \{\phi, X, \{1\}, \{3\}, \{4\}, \{1,3\}, \{1,4\}, \{3,4\}, \{1,3,4\}, \{2,3,4\}\}$

Result3.5: In a space $(X, \mathfrak{F}_{\mathfrak{K}}(Ą), \mu_{\mathfrak{K}}(Ą))$ we have,

1) Each M. g. closed is M. αg. closed.
2) Each M. g. α closed is M. αg. closed.

Proof:

1) Assume that $ß \in MgC(X)$ in a space $(X, \mathfrak{F}_{\mathfrak{K}}(Ą), \mu_{\mathfrak{K}}(Ą))$ then Mic. $Cl.(ß) \subseteq Ʉ$ for $ß \subseteq Ʉ$ and for each Ʉ is Micro *open*. Since Mic. α − $Cl.(ß) \subseteq$ Mic. $Cl.(ß) \subseteq Ʉ$ for each Ʉ is Micro *open*, So $ß \in M\alpha gC(X)$.

2) Assume that $ß \in Mg\alpha C(X)$ in a space $(X, \mathfrak{F}_{\mathfrak{K}}(Ą), \mu_{\mathfrak{K}}(Ą))$ then Mic. α − $Cl.(ß) \subseteq Ʉ$ for $ß \subseteq Ʉ$ for each Ʉ is *Micro* α − *open*. Since 'every Micro *open* is *Micro* α − *open*' then Mic. α − $Cl.(ß) \subseteq Ʉ$ for $ß \subseteq Ʉ$ and for each Ʉ is Micro *open*, So $ß \in Mg\alpha C(X)$.

Remarks3.6: From the above result:

1) Not all ⍰. αg. closed is ⍰. g. closed like in the previous example the set ß = {4} ∈ ⍰αgC(Ꭓ) but ß ∉ ⍰gC(Ꭓ).

2) Also, not all ⍰. αg. closed must be ⍰. g. α closed as in the same example. The set Ŋ = {1,2,3} ∈ ⍰αgC(Ꭓ) but not belong to ⍰gαC(Ꭓ).

3) Both ⍰gC(Ꭓ) and ⍰gαC(Ꭓ) are independent as : The set $\mathcal{H}$ = {1,2} ∈ ⍰gC(Ꭓ) but not in ⍰gαC(Ꭓ) and ß = {4} ∈ ⍰gαC(Ꭓ) but not in ⍰gC(Ꭓ).

Proposition3.7: If each one of Ą and ß are ⍰ic. αg. −closed then Ą ∪ ß will be ⍰ic. αg. −closed.

Proof:

Suppose that Ą and ß are ⍰ic. αg. −closed then we have ⍰ic. α − $Cl.$ (Ą) ⊆ Ʉ for Ą ⊆ Ʉ for all Ʉ is ⍰icro α − $open$ and ⍰ic. α − $Cl.$ (ß) ⊆ Ʉ and for all ß ⊆ Ʉ for all Ʉ is ⍰icro $open$. Now, since Ą ⊆ Ʉ and ß ⊆ Ʉ , so Ą ∪ ß ⊆ Ʉ s.t. Ʉ is ⍰icro $open$, Then ⍰ic. α − $Cl.$ (Ą ∪ ß) = ⍰ic. α − $Cl.$ (Ą) ∪ ⍰ic. α − $Cl.$ (ß) ⊆ Ʉ hence, ⍰ic. α − $Cl.$ (Ą ∪ ß) ⊆ Ʉ $whenever$ Ą ∪ ß ⊆ Ʉ for all Ʉ is ⍰icro $open$ implies that Ą ∪ ß be ⍰ic. αg. −closed.

Remark3.8: The intersection of two ⍰ic. αg. −closed in a space (Ꭓ, 𝔉$_{\mathfrak{R}}$(Ą), ɰ$_{\mathfrak{R}}$(Ą)) is not ⍰ic. αg. −closed , since in example (3.4) {2,3,4}, {1,2,4} are ⍰ic. αg. −closed but {2,4} is not.

Definition3.9: The ⍰icro-ꞩemi-closure form a set ß of a ⍰icro topological space (Ꭓ, 𝔉$_{\mathfrak{R}}$(Ą), ɰ$_{\mathfrak{R}}$(Ą)) is the intersection of all ⍰icro-ꞩemi-closed sets that contain ß and denoted by ⍰ic. ꞩ − $Cl.$ (ß).

Definition3.10: A subset ß in a space (Ꭓ, 𝔉$_{\mathfrak{R}}$(Ą), ɰ$_{\mathfrak{R}}$(Ą)) is said to be ⍰icro generalized ꞩemi − closed (shortly ⍰ic. gꞩ − closed) if ⍰ic. ꞩ − $Cl.$ (ß) ⊆ Ʉ for ß ⊆ Ʉ and for all Ʉ is ⍰icro $open$. The complements of ⍰icro generalized ꞩemi − closed is called ⍰icro generalized ꞩemi − open.

Definition3.11: A subset ß of a space (Ꭓ, 𝔉$_{\mathfrak{R}}$(Ą), ɰ$_{\mathfrak{R}}$(Ą)) is said to be ⍰icro ꞩemi − generalized closed (shortly ⍰ic.ꞩ g − closed) if ⍰ic. ꞩ − $Cl.$ (ß) ⊆ Ʉ for ß ⊆ Ʉ for all Ʉ is ⍰icro ꞩemi $open$. The complements of ⍰icro ꞩemi −generalized closed is called ⍰icro ꞩemi −generalized open.

Example3.12: In example (3.4) let ɰ = {3}, The ⍰icro − topology is ɰ$_{\mathfrak{R}}$(Ą) = {ϕ, Ꭓ, {3}, {2,4}, {2,3,4}}. The Cɰ$_{\mathfrak{R}}$(Ą) = {ϕ, Ꭓ, {1,2,4}, {1,3}{1}}

We can write the collection of all ⍰icro ꞩemi open as:

⍰ꞩO(Ꭓ) = {ϕ, Ꭓ, {3}, {1,3}, {2,3}, {2,4}, {1,2,4}, {2,3,4}}

And the collection of ⍰icro ꞩemi closed as: ⍰ꞩC(Ꭓ) = {ϕ, Ꭓ, {1,2,4}, {2,4}, {1,3}, {3}, {1}}

Consider the table:

Table 2

P(Ꭓ)	⍰. ꞩ$Cl.$ (Ą)	⍰. g. ꞩ	⍰. ꞩg.
{1}	{1}	T	T
{2}	{2,4}	T	T
{3}	{3}	T	T
{4}	{2,4}	T	T
{1,2}	{1,2,4}	T	T
{1,3}	{1,3}	T	T
{1,4}	{1,2,4}	T	T
{2,3}	Ꭓ	F	F
{2,4}	{2,4}	T	T
{3,4}	Ꭓ	F	F
{1,2,3}	Ꭓ	T	T
{1,2,4}	{1,2,4}	T	T
{1,3,4}	Ꭓ	T	T
{2,3,4}	Ꭓ	F	F
ϕ	ϕ	T	T
Ꭓ	Ꭓ	T	T

In this table, the collection of ⍰gꞩC(Ꭓ) and ⍰ꞩgC(Ꭓ) are the same.

Example3.13: We take the universe set Ꭓ = {1,2,3,4} with the equivalence relation Ꭓ/$\mathfrak{R}$ = {{2}, {4}, {1,3}} and Ą = {1,2} then the $Nano - topology$ is 𝔉$_{\mathfrak{R}}$(Ą) = {ϕ, Ꭓ, {2}, {1,3}, {1,2,3}}. Let ɰ = {1}, The ⍰icro − topology is ɰ$_{\mathfrak{R}}$(Ą) = {ϕ, Ꭓ, {1}, {2}, {1,2}, {1,3}, {1,2,3}}. Sets of closed ⍰icro Cɰ$_{\mathfrak{R}}$(Ą) = {ϕ, Ꭓ, {2,3,4}, {1,3,4}, {3,4}, {2,4}, {4}}.

The collection of ⍰icro α-open is: ⍰αO(Ꭓ) = {ϕ, Ꭓ, {1}, {2}, {1,2}, {1,3}, {1,2,3}, {1,2,4}}. And ⍰icro α-closed as:

⍰αC(Ꭓ) = {ϕ, Ꭓ, {2,3,4}, {1,3,4}, {3,4}, {2,4}, {4}, {3}}

The collection of ⍰icro ꞩemi open is:

⍰ꞩO(Ꭓ) = {ϕ, Ꭓ, {1}, {2}, {1,2}, {1,3}, {1,4}, {2,4}, {1,2,3}, {1,3,4}, {1,2,4}}

And the collection of ⍰icro ꞩemi closed as:

ꞩC(Ꭓ) = {ϕ, Ꭓ, {2,3,4}, {1,3,4}, {3,4}, {2,4}, {2,3}, {1,3}, {4}, {2}, {3}}

Now, we will take the sets of all power of Ꭓ and we check which one of them are ⍰. αg. closed , ⍰. gα. $closed$, ⍰. ꞩg. closed and ⍰. g. ꞩ closed as in the table:

Table 3

P(Ꭓ)	⍰. ꞩ$Cl.$ (Ą)	⍰. ꞩg.	⍰. g. ꞩ	⍰. α$Cl.$ (Ą)	⍰. gα.	⍰. αg.
{1}	{1,3}	F	F	{1,3,4}	F	F
{2}	{2}	T	T	{2,4}	F	F
{3}	{3}	T	T	{3}	T	T
{4}	{4}	T	T	{4}	T	T
{1,2}	Ꭓ	F	F	Ꭓ	F	F
{1,3}	{1,3}	T	T	{1,3,4}	F	F
{1,4}	{1,3,4}	F	T	{1,3,4}	F	T
{2,3}	{2,3}	T	T	{2,3,4}	F	F
{2,4}	{2,4}	T	T	{2,4}	T	T
{3,4}	{3,4}	T	T	{3,4}	T	T
{1,2,3}	Ꭓ	F	F	Ꭓ	F	F
{1,2,4}	Ꭓ	F	T	Ꭓ	F	T
{1,3,4}	{1,3,4}	T	T	{1,3,4}	T	T
{2,3,4}	{2,3,4}	T	T	{2,3,4}	T	T
ϕ	ϕ	T	T	ϕ	T	T
Ꭓ	Ꭓ	T	T	Ꭓ	T	T

Here we consider four collections: The collection of Micro semi generalized closed

$MsgC(X) = \left\{ \begin{matrix} \phi, X, \{2\}, \{3\}, \{4\}, \{1,3\}, \{2,3\}, \{2,4\}, \{3,4\}, \\ \{1,3,4\}, \{2,3,4\} \end{matrix} \right\}$

The collection of Micro generalized semi closed

$MgsC(X) = \left\{ \begin{matrix} \phi, X, \{2\}, \{3\}, \{4\}, \{1,3\}, \{1,4\}, \{2,3\}, \{2,4\}, \{3,4\}, \\ \{1,2,4\}, \{1,3,4\}, \{2,3,4\} \end{matrix} \right\}$

The collection of

$Mg\alpha C(X) = \{\phi, X, \{3\}, \{4\}, \{2,4\}, \{3,4\}, \{1,3,4\}, \{2,3,4\}\}$

The collection of

$M\alpha gC(X) = \left\{ \begin{matrix} \phi, X, \{3\}, \{4\}, \{1,4\}, \{2,4\}, \{3,4\}, \{1,2,4\} \\ , \{1,3,4\}, \{2,3,4\} \end{matrix} \right\}$

Result3.14: In a space $(X, \mathfrak{F}_{\mathfrak{R}}(A), \mu_{\mathfrak{R}}(A))$ we have,

1) Each M. g. α closed is M. g. s closed.
2) Each M. αg. closed is M. g. s closed.
3) Each M. sg. closed is M. g. s closed.

Proof:

1) Assume that $ß \in Mg\alpha C(X)$ in a space $(X, \mathfrak{F}_{\mathfrak{R}}(A), \mu_{\mathfrak{R}}(A))$ then $Mic.\alpha Cl.(ß) \subseteq U$ for $ß \subseteq U$ for each U is Micro $\alpha - open$. Since 'every Micro $open$ is $Micro$ $\alpha - open$' and $Mic.s - Cl.(ß) \subseteq Mic.\alpha Cl.(ß) \subseteq U$ for each U is Micro $open$, So $ß \in MgsC(X)$.

2) Assume that $ß \in M\alpha gC(X)$ in a space $(X, \mathfrak{F}_{\mathfrak{R}}(A), \mu_{\mathfrak{R}}(A))$ then $Mic.\alpha - Cl.(ß) \subseteq U$ for $ß \subseteq U$ for each U is $Micro$ $open$. Since $Mic.s - Cl.(ß) \subseteq Mic.\alpha Cl.(ß) \subseteq U$ then $Mic.s - Cl.(ß) \subseteq U$ for $ß \subseteq U$ for each U is Micro $open$, So $ß \in MgsC(X)$.

3) Assume that $ß \in MsgC(X)$ in a space $(X, \mathfrak{F}_{\mathfrak{R}}(A), \mu_{\mathfrak{R}}(A))$ then $Mic.sCl.(ß) \subseteq U$ for $ß \subseteq U$ for each U is Micro $s - open$. Since 'every Micro $open$ is $Micro$ $s - open$' and $Mic.s - Cl.(ß) \subseteq U$ for $ß \subseteq U$ for each U is Micro $open$, So $ß \in MgsC(X)$.

Remarks3.15: From the above result:

1) Not all M. gs. closed be M. g. α closed like in the previous example the set $ß = \{2\} \in MgsC(X)$ but $ß \notin Mg\alpha C(X)$.
2) Also, not all M. gs. closed must be M. αg. closed as in the same example. The set $N = \{2,3\} \in MgsC(X)$ but not belong to $M\alpha gC(X)$.
3) Also, not all M. gs. closed must be M. sg. closed as in the same example. The set $N = \{1,2,4\} \in MgsC(X)$ but not belong to $MsgC(X)$.
4) Both $MsgC(X)$ and $M\alpha gC(X)$ are independent as : The set $\mathcal{H} = \{2\} \in MsgC(X)$ but not in $M\alpha gC(X)$ and $ß = \{1,4\} \in M\alpha gC(X)$ but not in $MsgC(X)$.

Finally, we obtain the following diagram from the previous results

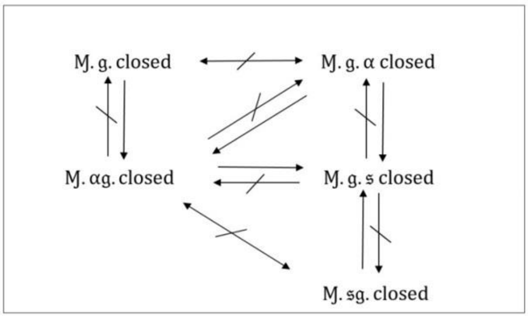

Diagram 1

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حول مايكرو ألفا المعممة المغلقة وشبه المعممة المغلقة في الفضاءات التبولوجية الدقيقة

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الملخص

سنقوم بعمل تعريفات جديدة في هذه الورقة وهي مايكرو ألفا معممة مغلقة ، مايكرو معممة ألفا مغلقة ، مايكرو معممة شبه مغلقة و مايكرو شبه معممة مغلقة. كما نعرض العلاقات بينهما في مخطط توضيحي ونعطي بعض النتائج والأمثلة.