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Design and Development of .Net Framework to Deal with Neutrosophic *gα Sets

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ABSTRACT--- This article introduces the design and development of neutrosophic *gα-closed sets via C# Application. Neutrosophic set operations of the complement, union, intersection and the inclusion of any two neutrosophic sets are designed and executed by using .NET Framework, Microsoft Visual Studio and C# Programming Language. Also it produces the results of neutrosophic topology, neutrosophic α-closed set and neutrosophic gα-closed set in neutrosophic topological spaces. The complement values of each neutrosophic closed sets are established via C# application in this computer application.

Index Terms - C# Application, Neutrosophic set operations, neutrosophic topology, neutrosophic *gα-closed set.

1. INTRODUCTION

Neutrosophic set initially proposed by Smarandache[1], which is a generalization of Atanassov's[2] intuitionistic fuzzy sets and Zadeh's[3] fuzzy sets. Also it considers truth-membership function [T], indeterminacy-membership function [I] and falsity-membership function [F]. This effective concept has been applied by many researchers in the last two decades to propose many concepts in topology. Salama and Alblowi[4] proposed a new concept in neutrosophic topological spaces and it provides a brief idea about neutrosophic topology, which is a generalization of Coker's[5] intuitionistic fuzzy topology and Chang's[6] fuzzy topology.

Salama et al.,[7,8,9] introduced the generalization of neutrosophic sets, neutrosophic crisp sets and neutrosophic closed sets in the field of neutrosophic topological spaces. These neutrosophic sets has been used by several researchers to define various neutrosophic open sets and neutrosophic closed sets in neutrosophic topology. Arokiarani et al.,[10] introduced neutrosophic alpha-closed sets in neutrosophic topological spaces, it deals with some other neutrosophic closed sets. Further several researchers have defined some closed sets in neutrosophic topology, namely neutrosophic alpha g-closed sets[11], neutrosophic b-closed sets[12], neutrosophic omega-closed sets[13], generalized neutrosophic closed sets[14], neutrosophic alpha-psi-closed sets[15], neutrosophic gα-closed set and neutrosophic *gα-closed set[16] in neutrosophic topological spaces. In these papers, most types of neutrosophic data operations, neutrosophic topological operations and neutrosophic closed set operations were presented with many routine works. In 2014, Salama et al.,[17] designed and implemented an object oriented programming[OOP] to deal with neutrosophic data operations, which produced the results only on netrosophic sets, union of neutrosophic sets, intersection of neutrosophic sets and the complement of neutrosophic sets. Recently, Saranya et al.,[18] introduced an application to deal with neutrosophic α-closed sets in neutrosophic topological spaces.

Here we have proposed a new application to deal with neutrosophic topological sets by using .NET Framework, Microsoft Visual Studio and C# Programming Language. It produces the results of neutrosophic set inclusion(⊆), neutrosophic topology and the neutrosophic closed sets of neutrosophic α-closed set, neutrosophic gα-closed set and neutrosophic *gα closed set apart from Salama et al.,'s[ ] complement of a neutrosophic sets, union of neutrosophic sets and the intersection of neutrosophic sets. It also execute the values of its complement at the end of the results of each resultant screens. This application will be very useful to the neutrosophic researchers.

Codings for neutrosophic set operations[complement, union, intersection and inclusion] are presented in section.2. Working process and results of C# application are presented in section.3. Flow charts of neutrosophic topology [complement of neutrosophic sets, union of neutrosophic sets, intersection of neutrosophic sets and the inclusion of two neutrosophic sets] , neutrosophic α-closed set, neutrosophic gα-closed set and neutrosophic *gα-closed set are given in Figure:1, Figure:4, Figure:6 and in Figure:8. These flow chart shows the working process of this new C# application. Figure:2 shows the initial resultant page[In this page, the user can enter 0N, 1N and the neutrosophic sets of L and M values]. Also, the results of neutrosophic topology[complement of neutrosophic sets, union of neutrosophic sets, intersection of neutrosophic sets and the inclusion of two neutrosophic sets], neutrosophic α-closed set, neutrosophic gα-closed set and neutrosophic *gα-closed set via C# application are shown in Figure:3, Figure:5, Figure:7 and in Figure:9. It also produces the values of its complement of each closed sets.

2. C# CODINGS FOR NEUTROSOPHIC SET OPERATIONS

2.1 Union Function:

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```
public string ClaculateUnion()
{
string Result = "";
string Set1 = "";
string Set2 = "";
string Set3 = "";
try
{
if(First_L>=First_M && Second_L >= Second_M &&
Third_L >= Third_M)
{
Set1 = "(" + First_L.ToString() + "," +
Second_L.ToString() + "," + Third_L.ToString()
+ ")";
}
else if (First_L <= First_M && Second_L <=
Second_M && Third_L <= Third_M)
{
Set1 = "(" + First_M.ToString() + "," +
Second_M.ToString() + "," + Third_M.ToString()
+ ")";
}
if (Fourth_L <= Fourth_M && Fivth_L <= Fivth_M
&& Six_L <= Six_M)
{
Set2 = "(" + Fourth_L.ToString() + "," +
Fivth_L.ToString() + "," + Six_L.ToString() +
")";
}
else if (Fourth_L >=Fourth_M &&
Fivth_L >=Fivth_M && Six_L >=Six_M)
{
Set2 = "(" + Fourth_M.ToString() + "," +
Fivth_M.ToString() + "," + Six_M.ToString() +
")";
}
if (Seven_L <= Seven_M && Eight_L <= Eight_M
&& Nine_L <= Nine_M)
{
Set3 = "(" + Seven_L.ToString() + "," +
Eight_L.ToString() + "," + Nine_L.ToString() +
")";
}
else if (Seven_L >=Seven_M &&
Eight_L >=Eight_M && Nine_L >=Nine_M)
{
Set3 = "(" + Seven_M.ToString() + "," +
Eight_M.ToString() + "," + Nine_M.ToString() +
")";
}
if (Set1 != "" && Set2 != "" && Set3 != "")
{
Result = "{" + Set1 + "," + Set2 + "," + Set3
+ "}";
LUnionM = Result;
}
else
Result = "Not matched";
}
return Result;
}
```

2.2 Complement of Union Function:

```
public string ClaculateEUnionMComplement()
{
string Result = "";
string Set1 = "";
string Set2 = "";
string Set3 = "";
try
{
if (First_E >= Seven_M && Second_E >= Eight_M
&& Third_E >= Nine_M)
{
Set1 = "(" + First_E.ToString() + "," +
Second_E.ToString() + "," + Third_E.ToString()
+ ")";
}
else if (First_E <= First_M && Second_E <=
Second_M && Third_E <= Third_M)
{
Set1 = "(" + First_M.ToString() + "," +
Second_M.ToString() + "," + Third_M.ToString()
+ ")";
}
if (Fourth_E <= (1 - Fourth_M) && Fivth_E <=
(1- Fivth_M) && Six_E <= (1 - Six_M))
{
Set2 = "(" + Fourth_E.ToString() + "," +
Fivth_E.ToString() + "," + Six_E.ToString() +
")";
}
else if (Fourth_E >=(1 - Fourth_M) &&
Fivth_E >=(1 - Fivth_M) && Six_E >=(1 -
Six_M))
{
Set2 = "(" + (1 - Fourth_M).ToString() + "," +
(1 - Fivth_M).ToString() + "," + (1 -
Six_M).ToString() + ")";
}
if (Seven_E <= First_M && Eight_E <= Second_M
&& Nine_E <= Third_M)
{
Set3 = "(" + Seven_E.ToString() + "," +
Eight_E.ToString() + "," + Nine_E.ToString() +
")";
}
else if (Seven_E >=First_M &&
Eight_E >=Second_M && Nine_E >=Third_M)
{
Set3 = "(" + First_M.ToString() + "," +
Second_M.ToString() + "," + Third_M.ToString()
+ ")";
}
if (Set1 != "" && Set2 != "" && Set3 != "")
{
Result = "{" + Set1 + "," + Set2 + "," + Set3
+ "}";
EUnionMComplement = Result;
}
else
{
```


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```
Result = "{User Value}";
EUnionMComplement = Result;
}
}
return Result;
}
```

2.3 Intersection Function:

```
public string ClaculateIntersection()
{
string Result = "";
string Set1 = "";
string Set2 = "";
string Set3 = "";
try
{
if (First_L <= First_M && Second_L <= Second_M
&& Third_L <= Third_M)
{
Set1 = "(" + First_L.ToString() + "," +
Second_L.ToString() + "," + Third_L.ToString()
+ ")";
}
else if (First_L >=First_M &&
Second_L >=Second_M && Third_L >=Third_M)
{
Set1 = "(" + First_M.ToString() + "," +
Second_M.ToString() + "," + Third_M.ToString()
+ ")";
}
if (Fourth_L >= Fourth_M && Fivth_L >= Fivth_M
&& Six_L >= Six_M)
{
Set2 = "(" + Fourth_L.ToString() + "," +
Fivth_L.ToString() + "," + Six_L.ToString() +
")";
}
else if (Fourth_L <= Fourth_M && Fivth_L <=
Fivth_M && Six_L <= Six_M)
{
Set2 = "(" + Fourth_M.ToString() + "," +
Fivth_M.ToString() + "," + Six_M.ToString() +
")";
}
if (Seven_L >= Seven_M && Eight_L >= Eight_M
&& Nine_L >= Nine_M)
{
Set3 = "(" + Seven_L.ToString() + "," +
Eight_L.ToString() + "," + Nine_L.ToString() +
")";
}
else if (Seven_L <= Seven_M && Eight_L <=
Eight_M && Nine_L <= Nine_M)
{
Set3 = "(" + Seven_M.ToString() + "," +
Eight_M.ToString() + "," + Nine_M.ToString() +
")";
}
if (Set1 != "" && Set2 != "" && Set3 != "")
{
Result = "{" + Set1 + "," + Set2 + "," + Set3
+ "}";
LIntersectionM = Result;
}
else
Result = "Not matched";
}
return Result;
}
```

2.4 Inclusion[Contained in] Function:

```
public string LContainedinM()
{
string Result = "";
bool Set1 = false;
bool Set2 = false;
bool Set3 = false;
try
{
if (First_L <= First_M && Second_L <= Second_M
&& Third_L <= Third_M)
{
Set1 = true;
}
if (Fourth_L <= Fourth_M && Fivth_L <= Fivth_M
&& Six_L <= Six_M)
{
Set2 = true;
}
if (Seven_L >= Seven_M && Eight_L >= Eight_M
&& Nine_L >= Nine_M)
{
Set3 = true;
}
if (Set1 && Set2 && Set3)
{
Result = "True";
}
else
Result = "False";
}
LContainedInM = Result;
return Result;
}
```

3. NEUTROSOPHIC TOPOLOGICAL SETS: WORKING PROCESS AND ITS RESULTS [VIA C# APPLICATION]

In this section, we have shown the working process of C# application for finding the values of the complement, union, intersection and the inclusion of any two neutrosophic sets. Also it produces the values of neutrosophic topology, neutrosophic α-closed set, neutrosophic gα-closed set and neutrosophic *gα-closed set values in neutrosophic topological spaces. The complements of each neutrosophic closed sets will be displayed at the end of the results of each resultant screens.

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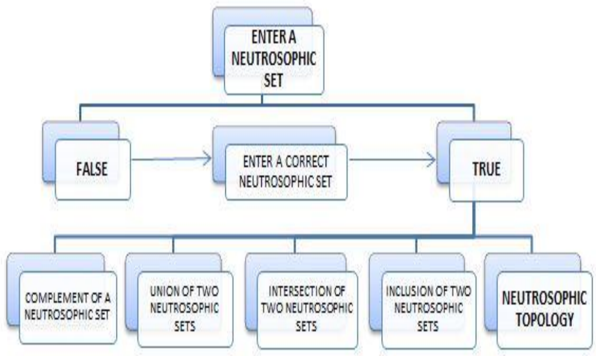

Figure:1 Flow chart of neutrosophic set operations & neutrosophic topology & Results

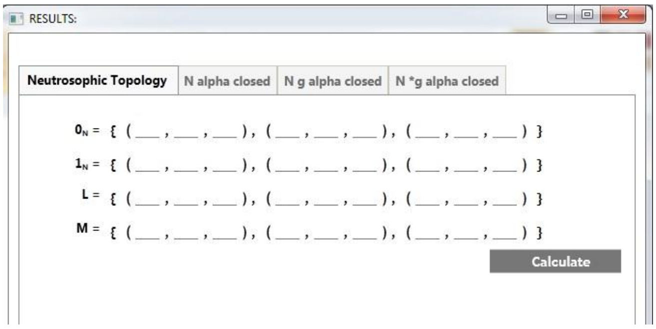

Figure:2 Initial resultant screen[User screen]

In the above resultant screen the user has to enter all the values of 0_N, 1_N , L and M. Follow the below conditions to enter the values:

- 0_N and 1_N values should be any three values of Definition 2.4 in [16],
- L and M values should be based on Definition 2.1 and Remark 2.2 of [16].

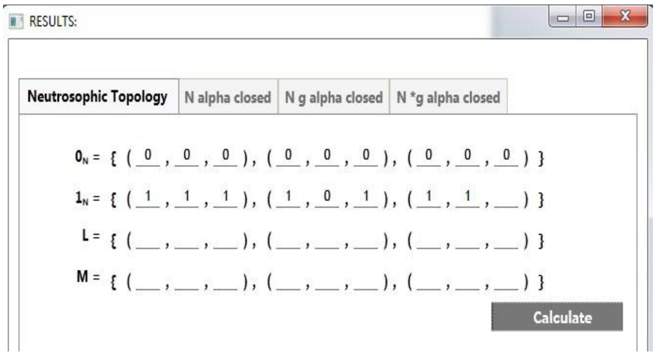

Figure: (a)

The above figure shows the entered values of the initial resultant screen. In this, some of the values are not entered by the user. For this incomplete data the following command box intimate the user to enter all the values.

Figure: (b)

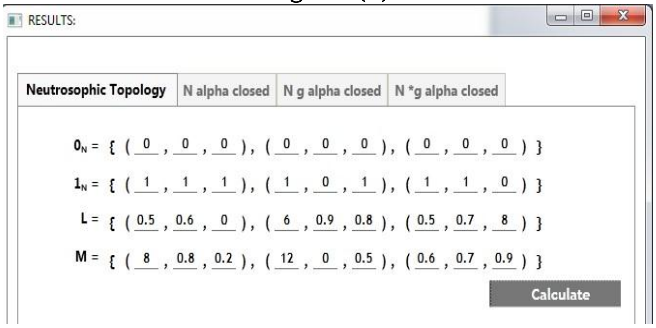

Figure: (c)

The above figure shows the entered values of the initial resultant screen. Here some of the values are not properly entered by the user. For this incorrect data the following command box intimate the user to enter the values between 0 and 1. In this the user not followed the conditions to enter L and M. Both L and M should be a neutrosophic values.

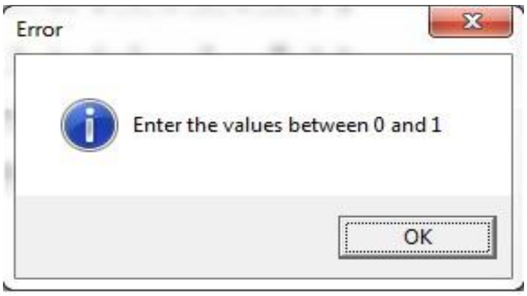

Figure: (d)

The following figure shows the results of the complement of two neutrosophic sets[$\bar{L}$ and $\bar{M}$], union of two neutrosophic sets[L∪M], intersection of two neutrosophic sets[L ∩ M] and the inclusion of two neutrosophic sets [L ⊆ M]. Also it shows the result of neutrosophic topology.

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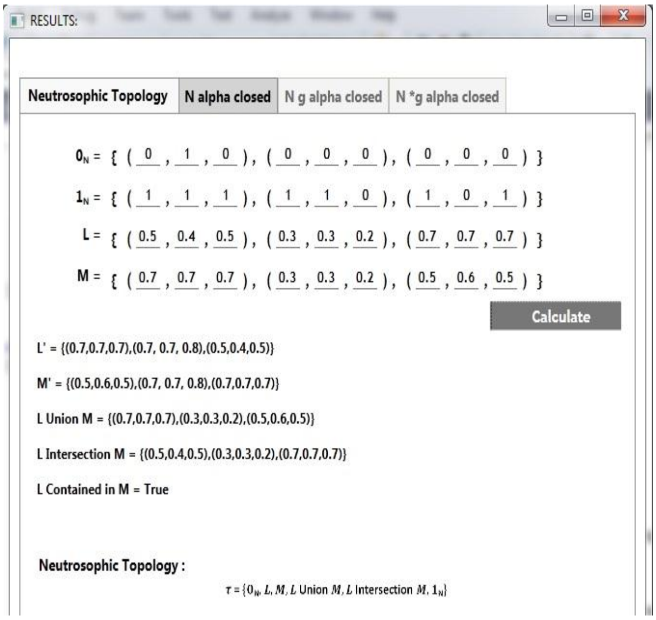

Figure:3 Results of neutrosophic set operations & neutrosophic topology

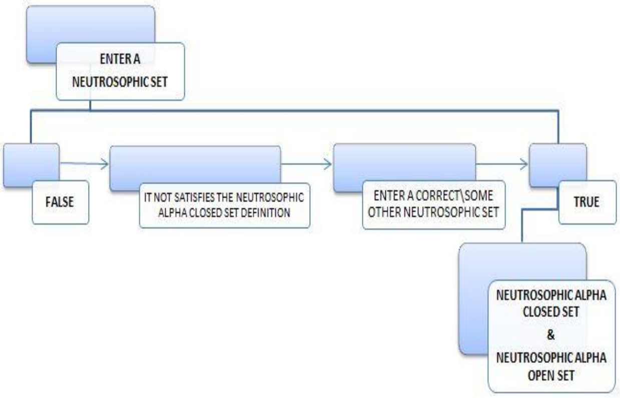

Figure:4 Flow chart of neutrosophic α-closed set

The following figure shows that the entered neutrosophic set (C) is not satisfies the definition of neutrosophic closure. To get a neutrosophic α-closed set and a neutrosophic α-open set, the user has to enter someother neutrosophic values. Repeat this process until to get a values of neutrosophic α sets.

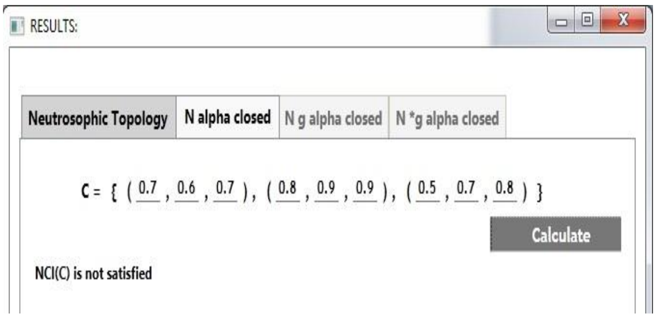

Figure: (e)

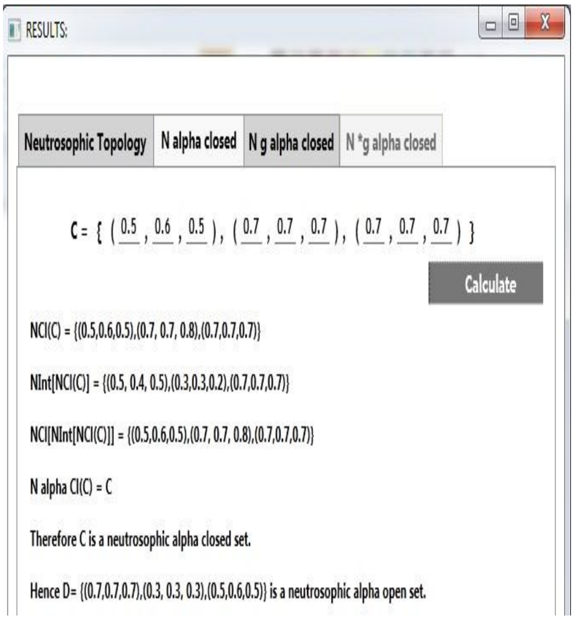

Figure:5 Result of neutrosophic α-closed set

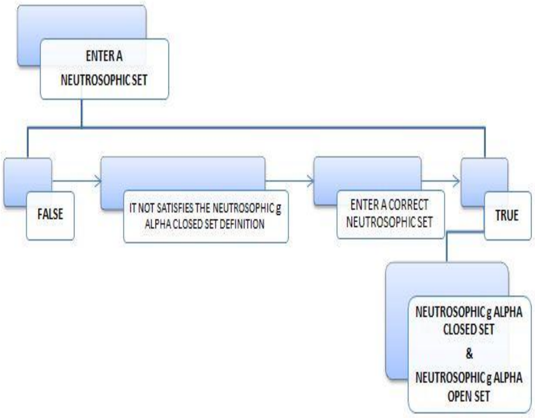

Figure:6 Flow chart of neutrosophic gα-closed set

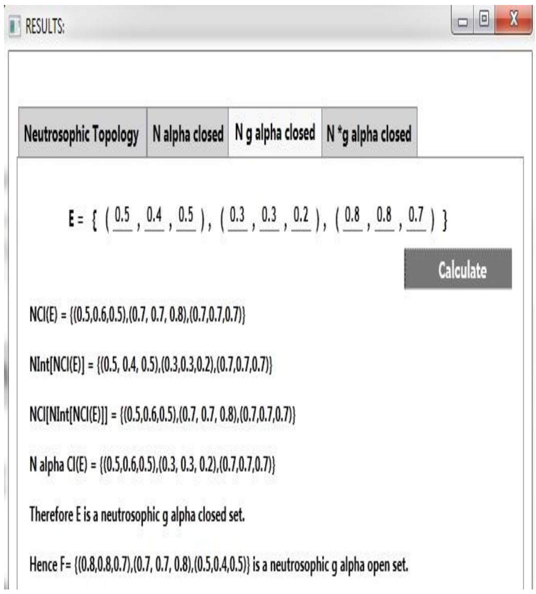

Figure:7 Result of neutrosophic gα-closed set

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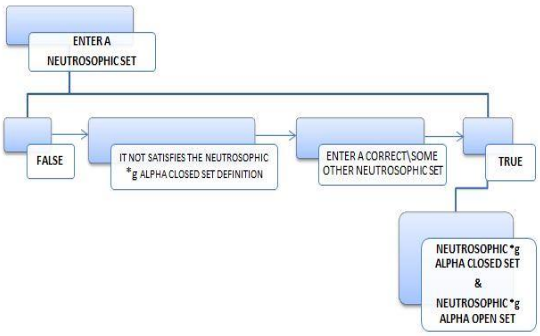

Figure:8 Flow chart of neutrosophic *gα-closed set

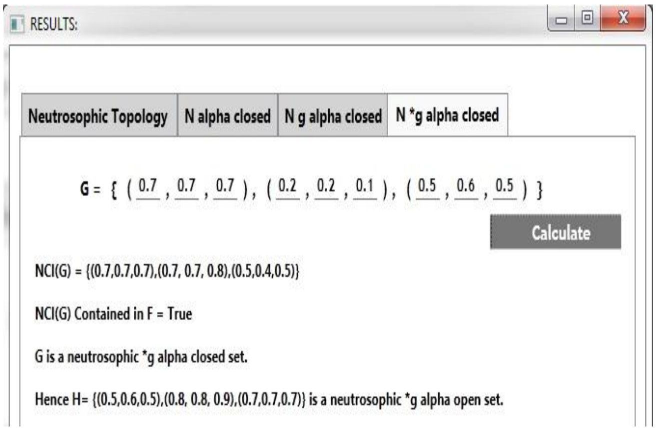

Figure:9 Result of neutrosophic *gα-closed set

4. CONCLUSION

In this paper, new .NET framework has been introduced and discussed its working process via .NET Framework, Microsoft Visual Studio and C# Programming Language in the neutrosophic field. Also the existence of the complement of a neutrosophic set, union of two neutrosophic sets, intersection of two neutrosophic sets, the inclusion of two neutrosophic sets, neutrosophic topology, neutrosophic α-closed set, neutrosophic gα-closed set, neutrosophic *gα-closed set and the complements of each neutrosophic closed sets in neutrosophic topological spaces has been presented in each figures. In a short period of time *n number of neutrosophic* closed and open sets can be produced by using this C# application.

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NOMENCLATURE

*g	star generalized
B	mathematical notation
N	neutrosophic

Greek symbols

α	mathematical notation
ψ	mathematical notation
ω	mathematical notation

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