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Shortest Path Problem in Network with Quadripartitioned neutrosophic Arc Length

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Abstract

Many extensions and generalizations of neutrosophic sets have been introduced and studied in the literature. Quadripartitioned single valued neutrosophic set becomes an important tool in solving various types of decision making problems, medical diagnosis problems, clustering,... etc. The neutrosophic graph has still been a powerful tool for modeling and designing indeterminate networks. Quadripartitioned single valued neutrosophic graph is a generalization of single valued neutrosophic graph. In this chaptre, we formulate the shortest path (SP) problem in Quadripartitioned single valued neutrosophic environment. Here, the costs related to arcs are taken in the form of Quadripartitioned single valued neutrosophic numbers (QSVNNs). A numerical example also included illustrating our proposed method for finding the neutrosophic shortest path.

Keywords: SPP, Network, Quadripartitioned neutrosophic sets, score function

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List of abbreviations:

SP	shortest path
QSVNNs	Quadripartitioned single valued neutrosophic numbers
FS	Fuzzy sets
IFS	Intuitionistic fuzzy sets
PyFSs	Pythagorean fuzzy sets
SVNS	Single Valued Neutrosophic Sets
QSVNNG	Quadripartitioned single valued neutrosophic nu

1. Introduction

Zadeh [21] established fuzzy sets (FS) in 1965, allowing items to have varying degrees of membership in the collection. The degrees of membership fall within the range of real units [0, 1]. Atnassov [1] proposed the intuitionistic fuzzy set (IFS) in 1983, which allows for both membership and non-membership to the elements. Smarandache [14] first introduced the neutrosophic set in 1998 by adding one additional component to the IFS set. Contrary to the examples recorded in IFSs, there are instances where $t + f > 1$. This IFS constraint prompted the development of a concept known as Pythagorean fuzzy sets (PyFSs). Yager [18-20] in 2013 presented Pythagorean fuzzy set (PyFS). The truth membership function (T_A), indeterminacy membership function (I_A), and falsity membership function (F_A) are the three components of the neurosophic set, respectively. Effective handling of the ambiguous and inconsistent information is made possible by this neutrosophic collection. Later, Single Valued Neutrosophic Set (SVNS), a generalisation of the classic set, fuzzy set, and intuitionistic fuzzy set was introduced by Wang [17].

Smarandache [15] introduced quadripartitioned single valued neutrosophic set (QSVNS) in 2013. The neutrosophic set was further extended by Smarandache to the refined [n-valued] neutrosophic set in [16], where the truth value T is refined/split into sub-truths of the types T_1, T_2,..., indeterminacy I is refined/split into sub-indeterminacies of the types I_1, I_2,..., and the falsehood F is refined/split into sub-falses of the types F_1, F_2,...,. Additionally, he demonstrated in this study how a quadruple neutrosophic set may be obtained by refining/splitting only indeterminacy (I) into I_1 = Contradiction and I_2 = Uncertainty. But there are a lot more subcomponents that can be refined/split into the I as T as F. (as many as needed into each application). By R. Chatterjee et al. [5] in 2016, quadripartitioned single valued neutrosophic sets were once more examined in depth. It is a four-valued logic set A over a universal set X composed of the memberships of truth (T_A), contradiction (C_A), ignorance (U_A), and falsity (F_A) for each x□X. The quadripartitioned single valued neutrosophic set is now a crucial instrument for resolving numerous decision-making issues, diagnostic issues in medicine, clustering issues, etc. [3,6]. Many studies on quadripartitioned single valued neutrosophic set are appeared in [2226]

The easiest and most fascinating subject is fuzzy network problems. Finding a way with the least amount of distance and expense is the optimal path problem's main driving force. Dubois appears to have developed the fuzzy shortest path problem [9]. As a result, the researchers have taken alternative approaches to solving a distinct kind of SP problem. A fuzzy SP algorithm based on the possibility degree of each arc was proposed by Okada [12]. The concept of the degree of possibility that an arc is an optimal path problem was put forth by Okada and Soper in their [13] improvement of the optimised path problem. Chuang and Kung [8], however, presented a way to determine the fuzzy shortest path length among all potential paths in a network in order to get around the computational difficulty and membership function complexity. Baba [2] proposed the intuitive fuzzy network shortest path issue using the centroid method. The suggested algorithm's disadvantage is that it requires more computer work and is challenging in large-scale networks. There are some issues with the current algorithm for determining the shortest path in various fuzzy environments.Broumi et al [27] proposed the shortest path problem using Bellman algorithm under neutrosophic environment.Finding the shortest path problem for quadripartitioned single valued neutrosophic numbers (QSVNN) is therefore practical because it offers superior performance, interpretation, and outputs than the methods covered by Enayattabar et al. [10] and Jan et al.[11]; this is the driving force behind this study.

To the best of the authors' knowledge, no research has been done on computing SPP under the context of Quadripartitioned single valued neutrosophic information The organization of the chaptre is as follows:

Preliminary ideas for the study have been described in section 2 with the appropriate sources. In section 3, we give the basic arithmetic operations and their examples for a QSVNN. In section 4, we defined an algorithm and a flow diagram for finding the shortest path in the QSVN environment also as an application we attempted to use the QSVN set and the algorithm for finding the shortest path to address a problem from real life. A comparative analysis of the proposed technique with the existing ones is given in section 5. The chaptre is concluded in Section 6.

2. Préliminaries

In order to create a useful tool for inference, Belnap [4] presented the idea of a four valued logic. He evaluated four options in his work, namely T: just True, F: only false, None: neither True nor False, and Both: both True and False, for a given piece of information.

He represented these four truth values as 4 = T, F, Both, and None such that any potential values would meet the criteria listed in Table 1 for each.

Definition 2.1. [5]

Let U be a universe. A quadripartitioned neutrosophic set A on U is defined as = {⟨x, (x), ℂ ( ), (x), ( )⟩: x ∈ U}, Where (x), ℂ ( ), (x), ( ): X → [0,1], and 0 ≤ (x) + ℂ ( ) + (x) + ( ) ≤ 4. Here (x) is the truth membership, ℂ ( ) is the contradiction membership, (x) is the ignorance membership and ( ) is the false membership.

(i) One property: If QSVNS Q = ⟨x, (x), c (x), u (x), f (x)⟩|x ∈ X is absolute, i.e., Q = ⟨1,1,0,0⟩, then = 1, i.e., the maximum value of QSVNN is 1

(ii) Zero property: If QSVNS Q = ⟨x, (x), c (x), u (x), f (x)⟩|x ∈ X is void, i.e., Q = ⟨0,0,1,1⟩, then 01, i.e., the minimum value of QSVNN is 0

3. Arithmetic Operations on QSVNNs

Definition 3.1 [5]. Let $= \langle \ , \mathbb{C}, \ , \ \rangle$, $= \langle \ , \mathbb{C}, \ , \ \rangle$ and $= \langle \ , \mathbb{C}, \ , \ \rangle$ be three quadripartitioned single valued neutrosophic numbers and > 0. Then, the operations rules are defined as follows;

- ➢ $\oplus = \langle \ + \ - \ , \mathbb{C} + \mathbb{C} - \mathbb{C}\,\mathbb{C}, \ , \ \rangle$
- ➢ $\otimes = \langle \ , \mathbb{C}\,\mathbb{C}, \ + \ - \ , \ + \ - \ \rangle$
- ➢ $= \langle 1 - (1 - \ ), 1 - (1 - \mathbb{C}), \ , \ \rangle$
- ➢ $= \langle \ , \mathbb{C}, 1 - (1 - \ ), 1 - (1 - \ ) \rangle$

Example 3.2. Let $= \langle 0.4, 0.2, 0.3, 0.1 \rangle$, $= \langle 0.5, 0.4, 0.7, 0.3 \rangle$ be two Quadripartitioned single valued neutrosophic numbers and $= 0.5$. Then

- $\oplus = \langle 0.07, 0.52, 0.21, 0.03 \rangle$
- $\otimes = \langle 0.02, 0.08, 0.79, 0.37 \rangle$
- $= \langle 0.23, 0.11, 0.55, 0.32 \rangle$
- $= \langle 0.63, 0.45, 0.16, 0.05 \rangle$

Definition 3.3[22]. To make a comparison between two quadripartitioned single valued neutrosophic numbers (QSVNNs). The score function is applied to compare the grades of QSVNNS. This function shows that greater is the value, the greater is the quadripartitioned single valued neutrosophic sets and by using this concept paths can be ranked. Let $= \langle \ , \mathbb{C}, \ , \ \rangle$ be a, quadripartionned single valued neutrosophic number, then, the score function ( ) of an QSVNN are defined as follows:

$$(\quad) = \frac{\quad \mathbb{C}}{\qquad}$$

$$, \ h \qquad (\quad) \in [0,1]$$

Ranking of Quadripartitioned single valued neutrosophic number

Depending upon the score function of QSVNNs, the ranking technique for any two QSVNNs can be defined as:

Definition 3.4. Let $= \langle \ , \mathbb{C}, \ , \ \rangle$ and $= \langle \ , \mathbb{C}, \ , \ \rangle$ be two QSVNNs. ( ) are the score values of and , respectively, then

- ➢ If $(\quad) < (\quad)$, then $<$;

- If ( ) > ( ), then > ;
- If ( ) = ( ), then = ;

4. Algorithm and flow chart of the proposed technique

In this section, we introduce an algorithm for determining the shortest path from each node to its predecessor. This algorithm proves to be beneficial in real-life scenarios when searching for the shortest path within a network.

Step 1: Identify the first and final nodes of destination as v and v

Step 2: Take $d = \langle 0, 0, 1, 1 \rangle$ as there is no distance of node 1 from itself. Further, label the first node as $(\langle 0, 0, 1, 1 \rangle\ ,\ -)$.
Step 3: Find $d = \min\ d \oplus d$. For j = 2,3, … n. Since the numbers are QSVNNs so here we use the Score function, That is

$$(\ ) = \underline{\qquad\qquad\qquad} \mathbb{C}$$

Step 4: If the value of distance occurs against a unique i=r. Then j is marked as , .

If the values of distance do not occur against a unique i̧. It represents more than one QSVNN paths from a node. So, to get the shortest among several paths, use the score function of QSVNNs

Step 5: Let [,] is the label of the destination node then the shortest displacement between initial and final node is

Step 6: Since [,]is the label as destination node. So, for finding QSVNN shortest path from first node to last node, we check the label of node . Let it be [,]. Then we check the label of node and so on. Repeat this process to obtain the initial node.

Step 7: Hence, the QSVNN shortest path can be obtained by using step 6.

Flow chart for the proposed algorithm is given in Fig. 1

4.1 Numerical Example

Let's examine a network represented by QSVNNG, as depicted in Figure 2. The QSVNN-based distances between the vertices are taken into account. By employing the suggested approach, we can compute the shortest path as illustrated below.

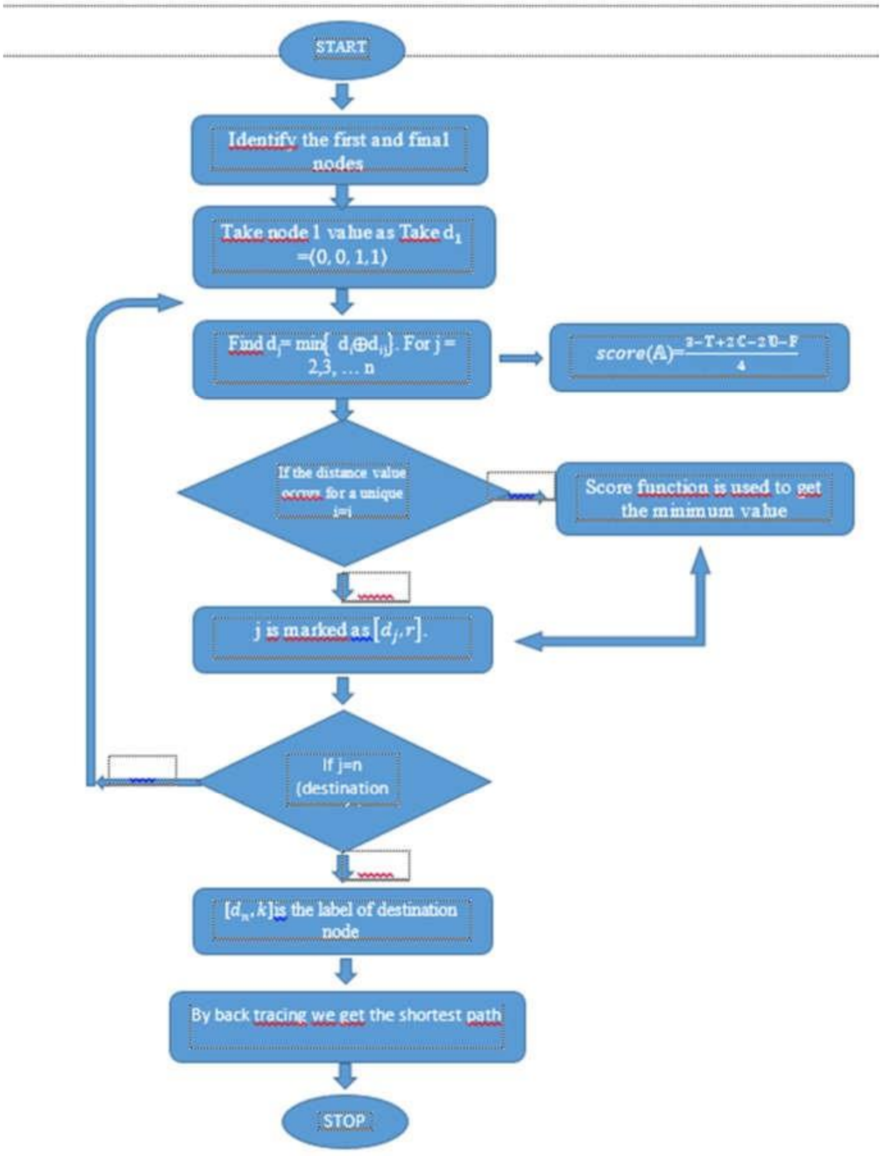

Fig. 1: Flow chart for the proposed algorithm

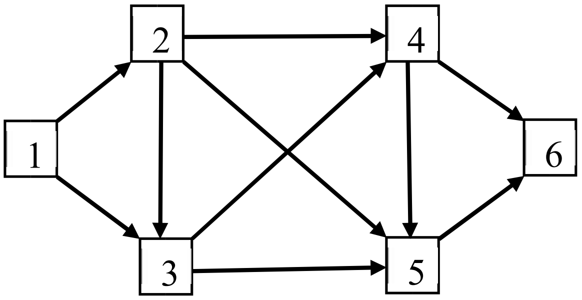

Fig. 2: QSVN network.

The path between every two nodes is described in Table 1 using QSVNNs.

Table 1: (QSVN Network edges).

edges	distance
(1, 2)	⟨0.4, 0.3, 0.5,0.9⟩
(1, 3)	⟨0.2, 0.6, 0.3,0.4⟩
(2, 3)	⟨0.3, 0.7, 0.4,0.5⟩
(2, 4)	⟨0.2, 0.4, 0.7,0.3⟩
(2, 5)	⟨0.4, 0.6, 0.5,0.4⟩
(3, 4)	⟨0.4, 0.2, 0.7,0.2⟩
(3, 5)	⟨0.5, 0.4, 0.1,0.5⟩
(4, 5)	⟨0.8, 0.7, 0.3,0.8⟩
(4, 6)	⟨0.6, 0.3, 0.6,0.7⟩
(5,6)	⟨0.8 ,0.6 ,0.3 ,0.5⟩

To determine the shortest path, we employ the algorithm outlined below:

Since our destination node is 6, we set n = 6. We begin with $d = \langle 0, 0, 1,1\rangle$ and designate the source node $(\langle 0,0, 1,1\rangle, -)$, which corresponds to node 1. We proceed to compute d using the following steps.

Iteration 1:

Given that the only predecessor of node 2 is node 1, we assign the values i = 1 and j = 2, following the algorithm. Consequently, we obtain d as a result of this computation. $d = \min\{d \oplus d\}$

$$= \min(\langle 0, 0, 1,1\rangle \oplus \langle 0.4, 0.3, 0.5,0.9\rangle))$$

$$= \langle 0.4, 0.3, 0.5,0.9\rangle$$

The minimum value is obtained for a single value i = 1. Therefore, we label vertex 2 as [⟨0.4, 0.3, 0.5, 0.9⟩-1] based on this calculation.

Iteration 2:

As node 3 has predecessors 3, we assign the values i = 1, 2 and j =3, as dictated by the algorithm

$$d = \min\{d \oplus d \quad , d \oplus d \quad \}$$

$$= \min\{\langle 0, 0, 1,1\rangle \oplus \langle 0.2, 0.6, 0.3,0.4\rangle, \langle 0.4, 0.3, 0.5,0.9\rangle \oplus \langle 0.3, 0.7, 0.4,0.5\rangle\}$$

= min{⟨0.2, 0.6, 0.3,0.4⟩, ⟨0.58, 0.79, 0.2,0.45⟩} Using score function, we can get the minimum:

S(⟨0.2, 0.6, 0.3,0.4⟩) = 0.75 and

S(⟨0.58, 0.79, 0.2,0.45⟩) = 0.787

So, the d =⟨0.2, 0.6, 0.3,0.4⟩

The minimum occurs for i = 1. So, vertex 3 is labeled as [⟨0.2, 0.6, 0.3,0.4⟩ , 1].

Iteration 3:

As node 4 has predecessors 2, 3, and 4, we assign the values i = 2, 3, 4 and j = 4, as dictated by the algorithm

$d = \min\{d \oplus d \quad , d \oplus d \quad \}$

= min{⟨0.4, 0.3, 0.5,0.9⟩ ⊕ ⟨0.2, 0.4, 0.7,0.3⟩, ⟨0.2,0.6,0.3,0.4⟩ ⊕ ⟨0.4,0.2,0.7,0.2⟩}

= min{⟨0.52, 0.58, 0.37,0.27⟩, ⟨0.52, 0.68, 0.79,0.52⟩} Using score function, we can get the minimum:

S(⟨0.52, 0.58, 0.37,0.27⟩) = 0.657 and

S(⟨0.52, 0.68, 0.79,0.52⟩) = 0.435

So, the d =⟨0.52, 0.68, 0.79,0.52⟩

The minimum occurs for i = 3. So, vertex 4 is labeled as [⟨0.52, 0.68, 0.79,0.52⟩ ,3].

Iteration 4:

As node 5 has predecessors 2, 3, and 4, we assign the values i = 2, 3, 4 and j = 5, as dictated by the algorithm

$d = \min\{d \oplus d \quad , d \oplus d \quad , d \oplus d \quad \}$

= min{⟨0.4, 0.3, 0.5,0.9⟩ ⊕ ⟨0.4, 0.6, 0.5,0.4⟩, ⟨0.2, 0.6, 0.3,0.4⟩ ⊕ ⟨0.5, 0.4, 0.1,0.5⟩, ⟨0.52, 0.68, 0.79, 0.52⟩ ⊕ ⟨0.8, 0.7, 0.3, 0.8⟩}

= min{⟨0.64, 0.72, 0.75, 0.94⟩, ⟨0.7, 0.76, 0.55, 0.7⟩, ⟨0.904, 0.904, 0.853, 0.904⟩}

Using score function, we can get the minimum:

S(⟨0.64, 0.72, 0.75,0.94⟩) = 0.34 S(⟨0.7, 0.76, 0.55,0.7⟩) = 0.505 and

S(⟨0.904, 0.904, 0.853, 0.904⟩) = 0.323.

So, the d =⟨0.904, 0.904, 0.853, 0.904⟩

The minimum occurs for i = 4. So, vertex 5 is labeled as [⟨0.904, 0.904, 0.853, 0.904⟩, 4].

Iteration 5:

As node 6 has predecessors 4 and 5, we assign the values i = 4, 5 and j = 6, as dictated by the algorithm

d = min{d ⊕ d , d ⊕ d }

= min{⟨0.52, 0.68, 0.79,0.52⟩ ⊕ ⟨0.6, 0.3, 0.6,0.7⟩, ⟨0.904,0.904,0.853,0.904⟩ ⊕ ⟨0.8,0.6,0.3,0.5⟩}

= min{⟨0.808, 0.776, 0.916, 0.556⟩, ⟨0.980, 0.961, 0.897, 0.952⟩}

By score function, we can get the minimum:

S(⟨0.808, 0.776, 0.916, 0.556⟩) = 0.264 and

S(⟨0.980, 0.961, 0.897, 0.952⟩) = 0.299

So, the d =⟨0.808, 0.776, 0.916, 0.556⟩

The minimum occurs for i =4. So, vertex 6 is labeled as [⟨0.808, 0.776, 0.916, 0.556⟩, 4].

Since the destination point is d . So, the shortest displacement from vertex one to six is provided as:

⟨0.808, 0.776, 0.916, 0.556⟩

The shortest way can be determined as follows:

Node 6 is labelled as [⟨0.808, 0.776, 0.916, 0.556⟩, 4].

Node 5 is labelled as [⟨0.904, 0.904, 0.853, 0.904⟩, 4].

Node 4 is labelled as [⟨0.52, 0.68, 0.79,0.52⟩ ,3].

Node 3 is labelled as [⟨0.2, 0.6, 0.3,0.4⟩ , 1].

Hence, the shortest way is 1⟶ 3 ⟶ 4 ⟶ 6 with the QSVNN value of distance being ⟨0.808, 0.776, 0.916, 0.556⟩

In Fig. 3 the dotted line represents the shortest path and Table 2 provides the path of different nodes

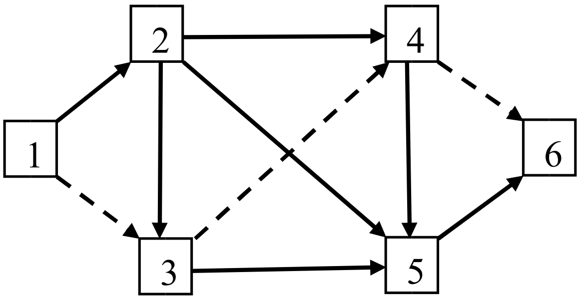

Fig. 3: QSVN shortest path of the given network.

Table 2 : shortest path

	d_i	Shortest path from1st node to jth node
Nodes No.(j)		
2	⟨0.4, 0.3, 0.5,0.9⟩	1 ⟶ 2
3	⟨0.2, 0.6, 0.3,0.4⟩	1 ⟶ 3
4	⟨0.52, 0.68, 0.79,0.52⟩	1 ⟶3⟶ 4
5	⟨0.904, 0.904, 0.853, 0.904⟩	1 ⟶ 3 ⟶ 4⟶ 5
6	⟨0.808, 0.776, 0.916, 0.556⟩	1 ⟶ 3⟶ 4⟶ 6

5. Comparative Analysis

Each theory or notions have their own advantages and in-built disadvantages because they can't handle at some situations. New theories have been brought to research while rectifying errors in previous notions. We showcase advantages and limitations of exisiting theories and our novel QSVNN.

Type of sets	Advantages	Limitations
FN[21]	It can handle uncertainties of each elements.	Non-membership of each elements is not discussed in this theory.
IFN[1]	This notion can handle both membership and non-membership of each elements	This notions fails when the sum of two grades exceeds 1. Also, contradiction grade is not discussed in this theory.

PyFN [18-20]	This notion was brought to research to rectify the limitation in IFN. That is, this can handle when sum of two grades exceeds 1.	It is not addressed contradiction grade and also, in some cases, sum of sqaure of two grades exceeds 1.
QSVNN (proposed)	This notion address the quadruple of each element.	Complex calculation compared to the previous methods

6. Conclusion

In this article, we present a new algorithm for calculating the shortest path in a network with QSVNN nodes. The key findings of our study are as follows:

- The concept of QSVNG is introduced which is an extension of single valued neutrosophic graph
- The basic operations of QSVNNs are presented in our work. Score function is also defined which is used to compare the two QSVNNs.
- We propose an algorithm for calculating the shortest path and demonstrate its implementation through a flowchart.
- We provide a numerical example to illustrate the application of our algorithm in computing the shortest path among all possible paths in a network.

In future one can find the new notion by incorporating QSVNNs and Soft set. Followed by an algorithm with an example to support the theory. Present notion motivates the researchers to study further in various dimensions.

References :

[1] Atanasov, K, Intuitionistic Fuzzy Sets, Fuzzy Sets and Systems.20 (1986), 87-96.
[2] Baba L (2013) Shortest path problem on intuitionistic fuzzy network. Ann Pure Appl Math 5(1):26–36
[3] Basset, MA., and Mohamed, M., (2018), The role of single valued neutrosophic sets and rough sets in smart city: Imperfect and incomplete information systems, Measurement, 124, 47-55.
[4] Belnap, ND, A useful four valued logic, Modern Uses of Multiple Valued Logic (1977), 9–37.
[5] Chatterjee, R., Majumdar, P. and Samanta, S. K., (2016), On some similarity measures and entropy on quadripartitioned single valued neutrosophic sets, Journal of Intelligent and Fuzzy Systems, 30, 2475–2485.
[6] Chatterjee, N., and Yadav, N., (2019), Fuzzy Rough Set-Based Sentence Similarity Measure and its Application to Text Summarization, IETE Technical Review, 36, 525527.
[7] Chatterjee, R., Majumdar, P. & Samanta, S.K. A multi-criteria group decision making algorithm with quadripartitioned neutrosophic weighted aggregation operators using

quadripartitioned neutrosophic numbers in IPQSVNSS environment. Soft Comput 24, 8857–8880 (2020). https://doi.org/10.1007/s00500-019-04417-1
[8] Chuang TN, Kung JY (2005) The fuzzy shortest path length and the corresponding shortest path in a network. Comput Operat Res 32(6):1409–1428. https://doi.org/10.1016/j.cor.2003.11.011
[9] Dubois D J (1980) Fuzzy sets and systems: theory and applications, vol. 144. Academic Press
[10] Enayattabar M, Ebrahimnejad A, Motameni H (2019) Dijkstra algorithm for shortest path problem under interval-valued Pythagorean fuzzy environment. Complex Intell Syst 5(2):93–100. https://doi.org/10.1007/s40747-018-0083-y
[11] Jan N, Aslam M, Ullah K, Mahmood T, Wang J (2019) An approach towards decision making and shortest path problems using the concepts of interval- valued Pythagorean fuzzy information. Int J Intell Syst 34(10):2403–2428. https://doi.org/10.1002/int.2215426
[12] Okada S (2004) Fuzzy shortest path problems incorporating interactivity among paths. Fuzzy Sets Syst 142(3):335–357. https://doi.org/10.1016/s0165-0114(03)00225-2
[13] Okada S, Timothy S (2000) A shortest path problem on a network with fuzzy arc lengths. Fuzzy Sets Syst 109:129–140
[14] Smarandache, F, (1999) A Unifying Field in Logics. Neutrosophy: Neutrosophic Probability, Set and Logic, Amer ican Research Press, Rehoboth.
[15] Smarandache, F., (2013), n-Valued Refifined Neutrosophic Logic and Its Applications in Physics, Progress in Physics,4, pp. 143-146.
[16] Smarandache, F., Neutrosophic Set is a Generalization of Intuitionistic Fuzzy Set, Inconsistent Intuitionistic Fuzzy Set (Picture Fuzzy Set, Ternary Fuzzy Set), Pythagorean Fuzzy Set, Submitted, https://arxiv.org/ftp/arxiv/papers/1911/1911.07333.pdf.
[17] Wang, H, Smarandache F, Zhang YQ, Sunderraman R (2010) Single valued neutrosophic sets, Multispace Multistruct 4, 410-413.
[18] Yager RR (2013) Pythagorean membership grades in multicriteria decision making. In: Technical report MII-3301. Machine Intelligence Institute, Iona College, New Rochelle 18.
[19] Yager RR (2013) Pythagorean fuzzy subsets. In: Proceedings of the joint IFSA world congress NAFIPS annual meeting, pp 57–61 19.
[20] Yager RR (2014) Pythagorean membership grades in multicriteria decision making. IEEE Trans Fuzzy Syst 22(4):958–965
[21] Zadeh, L, (1965) Fuzzy sets, Information and Control 8, 87-96.
[22] Mohanasundari, M. and K. Mohana. "Quadripartitioned Single valued Neutrosophic Dombi Weighted
Aggregation Operators for Multiple Attribute Decision Making." Neutrosophic Sets and Systems 32, 1
(2020). https://digitalrepository.unm.edu/nss_journal/vol32/iss1/9
[23] Broumi, S., Ajay, D., Chellamani, P., Malayalan, L., Talea, M., Bakali, A., ... & Jafari, S. (2022). Interval Valued Pentapartitioned Neutrosophic Graphs with an Application

to MCDM. Operational Research in Engineering Sciences: Theory and Applications, 5(3), 68-91.

[24] Hussain, S.S., Durga, N., Hossein, R. et al. New Concepts on Quadripartitioned SingleValued Neutrosophic Graph with Real-Life Application. Int. J. Fuzzy Syst. 24, 1515–1529 (2022). https://doi.org/10.1007/s40815-021-01205-8

[25] Shil, B., Das, R. ., Das, S., Tripathy, B. C., & Granados, C. (2022). Degree, Order and Size of Single-Valued Quadripartitioned Neutrosophic Graph. BISTUA Revista De La Facultad De Ciencias Básicas, 20(1), 63–69. https://doi.org/10.24054/01204211.v1.n%i.2022.1293

[26] Chatterjee, R., Majumdar, P., & Samanta, S. K. (2016). Interval-valued Possibility Quadripartitioned Single Valued Neutrosophic Soft Sets and some uncertainty based measures on them. Neutrosophic Sets Syst Neutrosophic Sets and Systems, vol. 14, ,

[27] Broumi, S.; Dey, A.; Talea, M.; Bakali, A.; Smarandache, F.; Nagarajan, D.; Lathamaheswari, M.; Kumar, R. Shortest path problem using Bellman algorithm under neutrosophic environment. Complex Intell. Syst. 2019, 5, 409–416