



## Multi-Valued Multi-Polar Neutrosophic Sets for Ideological and Political Education Quality in the New Media Environment

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**Abstract:** The quality of Ideological and Political Education (IPE) in higher education is being impacted more by the incorporation of new media platforms in the quickly changing world of digital communication. Under the impact of technologies like social media, short video apps, mobile learning platforms, and online discussion forums, this study investigates the essential elements that characterize and mold the quality of IPE. The study examines key variables such as media literacy, platform variety, student engagement, material correctness, and instructional adaptation using a multi-criteria assessment method. While new media has made it possible for more flexible, student-centered, and interactive methods to ideological education, it has also made it more difficult to manage disinformation, maintain ideological purity, and prepare teachers for digital pedagogy. This study uses the neutrosophic set to solve uncertainty problems. We use the Multi-Valued Multi-Polar Neutrosophic Sets to evaluate the criteria and alternatives.

In addition to highlighting best practices, the study offers a framework for ongoing evaluation and enhancement of IPE quality in the digital era. For educators, legislators, and institutional stakeholders seeking to improve the efficacy and pertinence of ideological education in a globalized society, the findings provide insightful information.

**Keywords:** Multi-Valued Multi-Polar Neutrosophic Sets; Ideological and Political Education; New Media Environment.

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### 1. Introduction and Literature Review

Due to the intricacy of biological systems, making judgments based on partial, unclear, or erroneous information can provide several difficulties. Important methods for dealing with incomplete information are provided by the Fuzzy Set (FS) theory and its implementation, which includes type n-fuzzy sets, Interval-Valued Fuzzy Sets (IVFS), Intuitionistic Fuzzy Sets (IFS), and

Interval-Valued Intuitionistic Fuzzy Sets (IVIFS). Conventional frameworks, however, are still unable to handle inconsistent and erroneous data[1], [2].

To overcome this limitation, Smarandache [3] created the concept of Neutrosophic Sets (NSs). When dealing with confusing, inconsistent, and inadequate data, NS theory is a useful tool. Single-Valued Neutrosophic Sets (SVNSs) were developed by Wang et al. [4] to address actual scientific and technical problems. In DM problems, SVNSs have recently gained a lot of attention and become a prominent study field. In recent years, NS and its application have attracted a lot of attention. As a result, we may use NSs, a crucial component of DM, to cope with partial data.

### 1.1 Related Works

The emergence of the new media period has brought about a change in the ideological and political education of college students to keep up with the times. The emphasis of societal attention has shifted to how to reinvent ideological and political education in the new media era, given the significance of college students developing into talents. To analyze the opportunities and challenges of new media technology in college students' ideological and political education, as well as the current state and developments of ideological and political education in the new media era, Yu [5] provided an overview of the traits of the new media era. Lastly, it attempts to consider the best way to enhance the efficacy of political and ideological education for college students in the age of new media.

The growing popularity and advancement of new media technologies has had a significant impact on college students. Additionally, new media tools have had a significant influence on the way that institutions currently teach politics and ideology. The contemporary media environment has brought up new demands for ideological and political education in higher education, as well as new development circumstances for the performance of such instruction. The efficient use of new media has on the one hand greatly reduced the distance between students and college faculty, making political and ideological instruction more convenient in higher education.

However, because new media is so open, it has had some impact on the authority of political and ideological work in colleges. It may also have an impact on the ability of the working staff of political and ideological education in colleges to lead, which has significantly undermined academic accomplishments. Currently, there is a pressing need to find an efficient way to use the new media environment to support political and ideological teaching at institutions. The primary focus of Zhang [6] is the present state of political and ideological teaching in higher education, as well as the approach used in the context of contemporary communications.

The 21st century is a productive time for science and technology. These days, new media technology has impacted every aspect of people's lives and production, resulting in significant changes. The manner and medium of information transmission have undergone significant changes in the modern era, which surely opens new possibilities for the development of ideological and political education in Chinese colleges and universities. China's colleges and

universities should aggressively maximize ideological and political education while fully grasping the opportunity presented by the times[7].

## 2. Multi valued Multi-Polar Neutrosophic Set (MVMPNS)

This section shows the combination of multi-valued and multi-polar neutrosophic set to show definitions of MVMPNSs[8].

### Definition 1

The MVMPNSs can be defined as:

$$A(b) = \left( \begin{array}{l} (s_1 \circ T_A(b), s_2 \circ T_A(b), \dots, s_m \circ T_A(b)), \\ (s_1 \circ I_A(b), s_2 \circ I_A(b), \dots, s_m \circ I_A(b)), \\ (s_1 \circ F_A(b), s_2 \circ F_A(b), \dots, s_m \circ F_A(b)) \end{array} \right)$$

$$A: B \rightarrow \left( \begin{array}{l} m \text{ sets of discrete values in } [0,1], \\ m \text{ sets of discrete values in } [0,1], \\ m \text{ sets of discrete values in } [0,1] \end{array} \right)$$

$s_i \circ T_A(b), s_i \circ I_A(b), s_i \circ F_A(b)$  are collections of discrete values  $x_i, y_i, z_i$

$s_1 \circ T_A(b)$  is truth membership function

$s_1 \circ I_A(b)$  is indeterminacy membership function

$s_1 \circ F_A(b)$  is facility membership function.

$$0 \leq x_i, y_i, z_i \leq 1$$

$$0 \leq x_i^+, y_i^+, z_i^+ \leq 3$$

$$x_i^+ \in \sup(s_i \circ T_A(b))$$

$$y_i^+ \in \sup(s_i \circ I_A(b))$$

$$z_i^+ \in \sup(s_i \circ F_A(b))$$

### Definition 2

Let two MVMPNs such as:

$$A(b_1) = \left( \begin{array}{l} (s_1 \circ T_A(b_1), s_2 \circ T_A(b_1), \dots, s_m \circ T_A(b_1)), \\ (s_1 \circ I_A(b_1), s_2 \circ I_A(b_1), \dots, s_m \circ I_A(b_1)), \\ (s_1 \circ F_A(b_1), s_2 \circ F_A(b_1), \dots, s_m \circ F_A(b_1)) \end{array} \right)$$

$$\begin{aligned}
&= \left( \left( \bigcup \{x_1^{(b1)}\}, \dots, \bigcup \{x_m^{(b1)}\} \right), \right. \\
&\quad \left( \bigcup \{y_1^{(b1)}\}, \dots, \bigcup \{y_m^{(b1)}\} \right), \\
&\quad \left. \left( \bigcup \{z_1^{(b1)}\}, \dots, \bigcup \{z_m^{(b1)}\} \right) \right) \\
A(b_2) &= \left( \begin{aligned} &(s_1 \circ T_A(b_2), s_2 \circ T_A(b_2), \dots, s_m \circ T_A(b_2)), \\ &(s_1 \circ I_A(b_2), s_2 \circ I_A(b_2), \dots, s_m \circ I_A(b_2)), \\ &(s_1 \circ F_A(b_2), s_2 \circ F_A(b_2), \dots, s_m \circ F_A(b_2)) \end{aligned} \right) \\
&= \left( \left( \bigcup \{x_1^{(b2)}\}, \dots, \bigcup \{x_m^{(b2)}\} \right), \right. \\
&\quad \left( \bigcup \{y_1^{(b2)}\}, \dots, \bigcup \{y_m^{(b2)}\} \right), \\
&\quad \left. \left( \bigcup \{z_1^{(b2)}\}, \dots, \bigcup \{z_m^{(b2)}\} \right) \right)
\end{aligned}$$

The complement operation can be defined as:

$$\begin{aligned}
(A(b_1))^c &= \left( \begin{aligned} &(s_1 \circ F_A(b_1), s_2 \circ F_A(b_1), \dots, s_m \circ F_A(b_1)), \\ &(s_1 \circ I_A(b_1), s_2 \circ I_A(b_1), \dots, s_m \circ I_A(b_1)), \\ &(s_1 \circ T_A(b_1), s_2 \circ T_A(b_1), \dots, s_m \circ T_A(b_1)) \end{aligned} \right) \\
&= \left( \left( \bigcup \{z_1^{(b1)}\}, \dots, \bigcup \{z_m^{(b1)}\} \right), \right. \\
&\quad \left( \bigcup \{y_1^{(b1)}\}, \dots, \bigcup \{y_m^{(b1)}\} \right), \\
&\quad \left. \left( \bigcup \{x_1^{(b1)}\}, \dots, \bigcup \{x_m^{(b1)}\} \right) \right)
\end{aligned}$$

### Definition 3

The addition can be defined as:

$$\begin{aligned}
A(b_1) \oplus A(b_2) &= \left( \left( \begin{aligned} &(s_1 \circ T_A(b_1), s_2 \circ T_A(b_1), \dots, s_m \circ T_A(b_1)), \\ &(s_1 \circ I_A(b_1), s_2 \circ I_A(b_1), \dots, s_m \circ I_A(b_1)), \\ &(s_1 \circ F_A(b_1), s_2 \circ F_A(b_1), \dots, s_m \circ F_A(b_1)) \end{aligned} \right) \oplus \right. \\
&\quad \left. \left( \begin{aligned} &(s_1 \circ T_A(b_2), s_2 \circ T_A(b_2), \dots, s_m \circ T_A(b_2)), \\ &(s_1 \circ I_A(b_2), s_2 \circ I_A(b_2), \dots, s_m \circ I_A(b_2)), \\ &(s_1 \circ F_A(b_2), s_2 \circ F_A(b_2), \dots, s_m \circ F_A(b_2)) \end{aligned} \right) \right) \\
&= \left( \begin{aligned} &(s_1 \circ T_A(b_1), s_2 \circ T_A(b_1), \dots, s_m \circ T_A(b_1)) \oplus (s_1 \circ T_A(b_2), s_2 \circ T_A(b_2), \dots, s_m \circ T_A(b_2)), \\ &(s_1 \circ I_A(b_1), s_2 \circ I_A(b_1), \dots, s_m \circ I_A(b_1)) \otimes (s_1 \circ I_A(b_2), s_2 \circ I_A(b_2), \dots, s_m \circ I_A(b_2)), \\ &(s_1 \circ F_A(b_1), s_2 \circ F_A(b_1), \dots, s_m \circ F_A(b_1)) \otimes (s_1 \circ F_A(b_2), s_2 \circ F_A(b_2), \dots, s_m \circ F_A(b_2)) \end{aligned} \right)
\end{aligned}$$

$$= \left( \left( \bigcup \{x_1^{(b1)} + x_1^{(b2)} - x_1^{(b1)} x_1^{(b2)}\}, \dots, \bigcup \{x_m^{(b1)} + x_m^{(b2)} - x_m^{(b1)} x_m^{(b2)}\} \right), \right. \\ \left. \left( \bigcup \{y_1^{(b1)} y_1^{(b2)}\}, \dots, \bigcup \{y_m^{(b1)} y_m^{(b2)}\} \right), \right. \\ \left. \left( \bigcup \{z_1^{(b1)} z_1^{(b2)}\}, \dots, \bigcup \{z_m^{(b1)} z_m^{(b2)}\} \right) \right)$$

**Definition 4**

The multiplication can be defined as:

$$A(b_1) \otimes A(b_1) = \left( \left( \begin{array}{l} (s_1 \circ T_A(b_1), s_2 \circ T_A(b_1), \dots, s_m \circ T_A(b_1)), \\ (s_1 \circ I_A(b_1), s_2 \circ I_A(b_1), \dots, s_m \circ I_A(b_1)), \\ (s_1 \circ F_A(b_1), s_2 \circ F_A(b_1), \dots, s_m \circ F_A(b_1)) \end{array} \right) \otimes \right. \\ \left. \left( \begin{array}{l} (s_1 \circ T_A(b_2), s_2 \circ T_A(b_2), \dots, s_m \circ T_A(b_2)), \\ (s_1 \circ I_A(b_2), s_2 \circ I_A(b_2), \dots, s_m \circ I_A(b_2)), \\ (s_1 \circ F_A(b_2), s_2 \circ F_A(b_2), \dots, s_m \circ F_A(b_2)) \end{array} \right) \right) \\ = \left( \begin{array}{l} (s_1 \circ T_A(b_1), s_2 \circ T_A(b_1), \dots, s_m \circ T_A(b_1)) \otimes (s_1 \circ T_A(b_2), s_2 \circ T_A(b_2), \dots, s_m \circ T_A(b_2)), \\ (s_1 \circ I_A(b_1), s_2 \circ I_A(b_1), \dots, s_m \circ I_A(b_1)) \oplus (s_1 \circ I_A(b_2), s_2 \circ I_A(b_2), \dots, s_m \circ I_A(b_2)), \\ (s_1 \circ F_A(b_1), s_2 \circ F_A(b_1), \dots, s_m \circ F_A(b_1)) \oplus (s_1 \circ F_A(b_2), s_2 \circ F_A(b_2), \dots, s_m \circ F_A(b_2)) \end{array} \right) \\ = \left( \begin{array}{l} \left( \bigcup \{x_1^{(b1)} x_1^{(b2)}\}, \dots, \bigcup \{x_m^{(b1)} x_m^{(b2)}\} \right), \\ \left( \bigcup \{y_1^{(b1)} + y_1^{(b2)} - y_1^{(b1)} y_1^{(b2)}\}, \dots, \bigcup \{y_m^{(b1)} + y_m^{(b2)} - y_m^{(b1)} y_m^{(b2)}\} \right), \\ \left( \bigcup \{z_1^{(b1)} + z_1^{(b2)} - z_1^{(b1)} z_1^{(b2)}\}, \dots, \bigcup \{z_m^{(b1)} + z_m^{(b2)} - z_m^{(b1)} z_m^{(b2)}\} \right) \end{array} \right)$$

**Definition 5**

The scalar multiplication can be defined as:

$$NA(b_1) = \left( \left( \bigcup \{1 - (1 - x_1^{(b1)})^N\}, \dots, \bigcup \{1 - (1 - x_m^{(b1)})^N\} \right), \right. \\ \left( \bigcup \{(x_1^{(b1)})^N\}, \dots, \bigcup \{(x_m^{(b1)})^N\} \right), \\ \left( \bigcup \{(x_1^{(b1)})^N\}, \dots, \bigcup \{(x_m^{(b1)})^N\} \right) \right)$$

**Definition 6**

The power scalar can be defined as:

$$(A(b_1))^N = \left( \begin{array}{l} \left( \bigcup \{(x_1^{(b1)})^N\}, \dots, \bigcup \{(x_m^{(b1)})^N\} \right), \\ \left( \bigcup \{1 - (1 - x_1^{(b1)})^N\}, \dots, \bigcup \{1 - (1 - x_m^{(b1)})^N\} \right), \\ \left( \bigcup \{1 - (1 - x_1^{(b1)})^N\}, \dots, \bigcup \{1 - (1 - x_m^{(b1)})^N\} \right) \end{array} \right)$$

### 3. Application

We show the results of Ideological and Political Education Quality in the New Media Environment. We use eight criteria and six alternatives as follows:

The criteria and alternatives are organized as follows:

- |  |  |
|--|--|
| • Content Accuracy and Political Alignment | ✓ Traditional Classroom and Social Media Supplementation   |
| • Interactivity and Engagement Level       | ✓ Online Video-Based Ideological Micro-Lectures            |
| • Media Literacy Integration               | ✓ Mobile App-Based Interactive Ideological Learning System |
| • Digital Platform Diversity               | ✓ Short-Video Platforms for Political Messaging            |
| • Personalization and Adaptability         | ✓ Integrated Learning Management System with IPE Modules   |
| • Feedback and Assessment Mechanisms       | ✓ AI-Based Personalized Ideological Education Assistant    |
| • Emotional and Moral Resonance            |  |
| • Faculty and Instructor Media Proficiency |  |

Four experts evaluate the criteria and alternatives using the MVMPNS as shown in Appendix Table 1.

We apply the score function to obtain crisp values such as:

$$S(b) = \frac{1}{m} \sum_{i=1}^m \left( \left( \frac{1}{l_{iT} l_{iU} l_{iF}} \sum \left( \frac{x_i - y_i - z_i}{3} \right) \right) \right)$$

The crisp values of this study are shown in Figure 1.

Hamming distance is applied to obtain each score of each alternative as shown in Figure 2.

Rank the alternatives as shown in Figure 3.

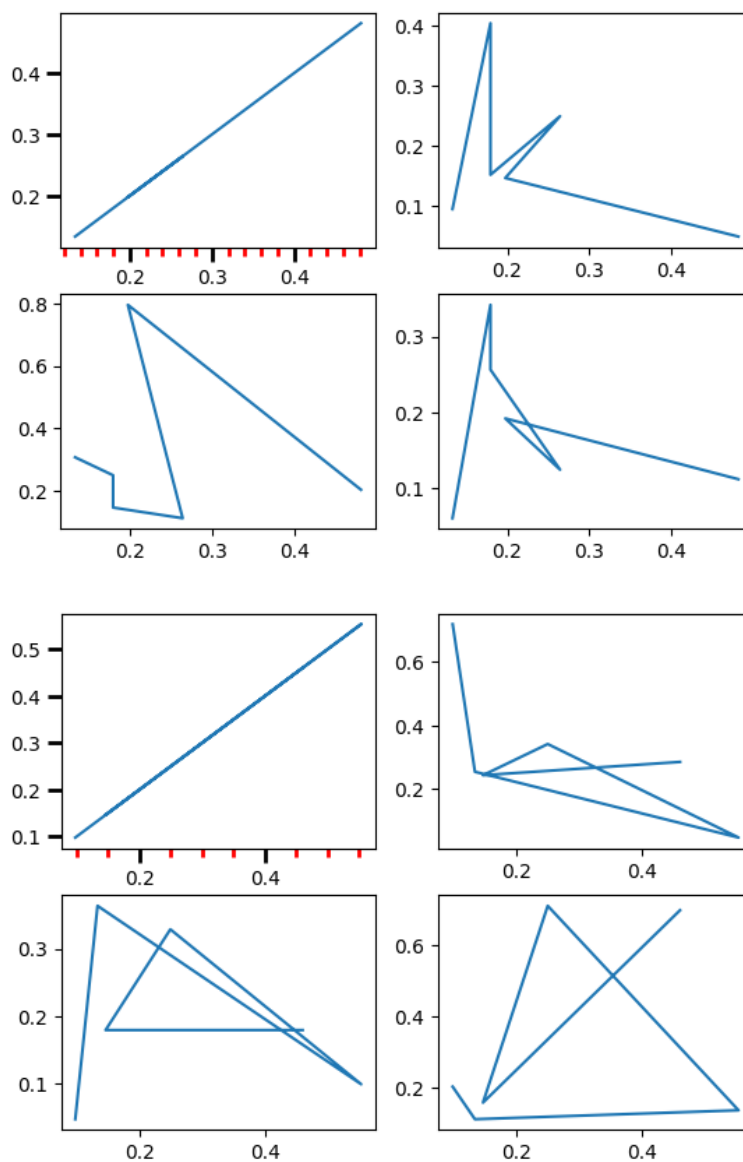


Figure 1. The crisp values.

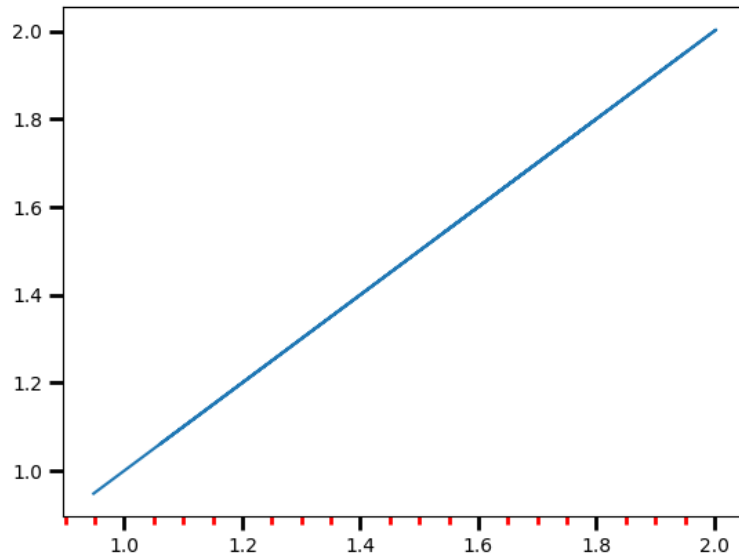


Figure 2. Hamming distance values.

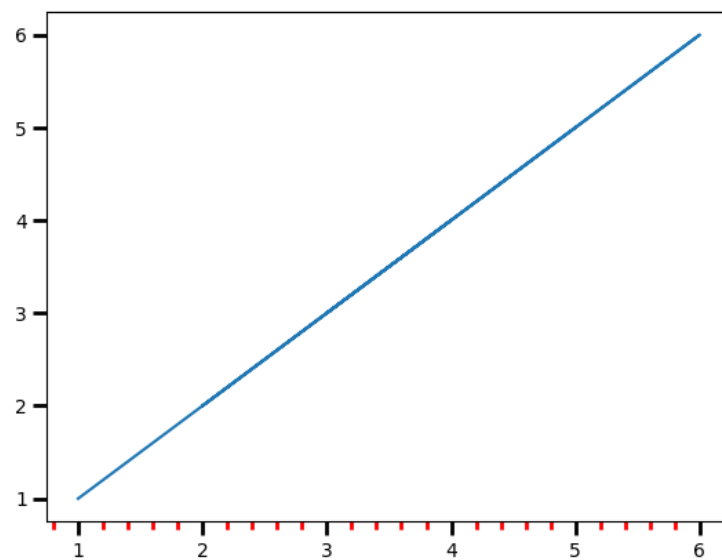


Figure 3. Rank the alternatives.

#### 4. Conclusions

According to the study's findings, the delivery and assessment of political and ideological education in higher education have been both improved and made more difficult by new media technologies. Learning management systems, social media, and video applications all increase accessibility and engagement, but they also carry hazards including diversion, ideological misalignment, and diluted information. In the digital environment, the suggested evaluation framework, which is based on multi-criteria assessment, aids in determining the advantages and

disadvantages of the present IPE methodologies. Personalized delivery, media-literate teaching, emotional resonance, and politically appropriate information are important success elements. To maintain quality, universities must make investments in technical infrastructure, digital training for teachers, and feedback systems. We used the Multi-Valued Multi-Polar Neutrosophic Sets to solve the uncertainty information. We combine the multi-valued neutrosophic sets with the multi-polar neutrosophic sets. We use the score function to obtain crisp values. Hamming distance is used to obtain a final score.

In an increasingly digital environment, future initiatives should concentrate on cross-platform governance, ethical AI integration, and adaptive learning models to guarantee that ideological education stays credible, effective, and in line with national ideals.

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## Appendix

Table A1. MVMPNS.

	MVMC <sub>1</sub>	MVMC <sub>2</sub>	MVMC <sub>3</sub>	MVMC <sub>4</sub>	MVMC <sub>5</sub>	MVMC <sub>6</sub>	MVMC <sub>7</sub>	MVMC <sub>8</sub>
MVMA <sub>1</sub>	{{(0.3), {0.4, 0.5}, {0.5, 0.6}}, {(0.4, 0.5), {0.2}, {0.7}}, {(0.3), {0.5}, {0.8}}}	{{(0.1), {0.3}, {0.6}}, {(0.2, 0.4), {0.6}, {0.7}, {0.8}}, {(0.5), {0.6}, {0.7, 0.8}}}	{{(0.4), {0.5, 0.6}, {0.4, 0.5}}, {(0.3, 0.4), {0.5}, {0.6}}, {(0.4), {0.3}, {0.7}}}	{{(0.5), {0.2}, {0.7}}, {(0.8, 0.5), {0.4}, {0.3}, {0.6}}, {(0.4), {0.5}, {0.3, 0.4}}}	{{(0.6), {0.2, 0.4}, {0.3, 0.2}}, {(0.4, 0.5), {0.7}, {0.2}}, {(0.1), {0.2}, {0.3}}}	{{(0.7), {0.2}, {0.7}}, {(0.7, 0.8), {0.8}, {0.3}, {0.5}}, {(0.4), {0.3}, {0.2, 0.8}}}	{{(0.1), {0.3}, {0.6}}, {(0.2, 0.4), {0.6}, {0.7}, {0.8}}, {(0.5), {0.6}, {0.7, 0.8}}}	{{(0.4), {0.5, 0.6}, {0.4, 0.5}}, {(0.3, 0.4), {0.5}, {0.6}}, {(0.4), {0.3}, {0.7}}}
MVMA <sub>2</sub>	{{(0.3), {0.4, 0.5}, {0.5, 0.6}}, {(0.4, 0.5), {0.2}, {0.7}}, {(0.3), {0.5}, {0.8}}}	{{(0.1), {0.3}, {0.6}}, {(0.2, 0.4), {0.6}, {0.7}, {0.8}}, {(0.5), {0.6}, {0.7, 0.8}}}	{{(0.7), {0.2}, {0.7}}, {(0.7, 0.8), {0.8}, {0.3}, {0.5}}, {(0.4), {0.3}, {0.2, 0.8}}}	{{(0.6), {0.2, 0.4}, {0.3, 0.2}}, {(0.4, 0.5), {0.7}, {0.2}}, {(0.1), {0.2}, {0.3}}}	{{(0.5), {0.2}, {0.7}}, {(0.8, 0.5), {0.4}, {0.3}, {0.6}}, {(0.4), {0.5}, {0.3, 0.4}}}	{{(0.4), {0.5, 0.6}, {0.4, 0.5}}, {(0.3, 0.4), {0.5}, {0.6}}, {(0.4), {0.3}, {0.7}}}	{{(0.3), {0.4, 0.5}, {0.5, 0.6}}, {(0.4, 0.5), {0.2}, {0.7}}, {(0.3), {0.5}, {0.8}}}	{{(0.5), {0.2}, {0.7}}, {(0.8, 0.5), {0.4}, {0.3}, {0.6}}, {(0.4), {0.5}, {0.3, 0.4}}}
MVMA <sub>3</sub>	{{(0.1), {0.3}, {0.6}}, {(0.2, 0.4), {0.6}, {0.7}, {0.8}}}	{{(0.4), {0.5, 0.6}, {0.4, 0.5}}, {(0.3, 0.4), {0.5}, {0.6}}, {(0.4), {0.3}, {0.7}}}	{{(0.5), {0.2}, {0.7}}, {(0.8, 0.5), {0.4}, {0.3}, {0.6}}, {(0.4), {0.5}, {0.3, 0.4}}}	{{(0.6), {0.2, 0.4}, {0.3, 0.2}}, {(0.4, 0.5), {0.7}, {0.2}}, {(0.1), {0.2}, {0.3}}}	{{(0.7), {0.2}, {0.7}}, {(0.7, 0.8), {0.8}, {0.3}, {0.5}}, {(0.4), {0.5}, {0.3, 0.4}}}	{{(0.1), {0.3}, {0.6}}, {(0.2, 0.4), {0.6}, {0.7}, {0.8}}}	{{(0.1), {0.3}, {0.6}}, {(0.2, 0.4), {0.6}, {0.7}, {0.8}}}	{{(0.6), {0.2, 0.4}, {0.3, 0.2}}, {(0.4, 0.5), {0.7}, {0.2}}, {(0.1), {0.2}, {0.3}}}

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<b>MVMA<sub>s</sub></b>	$\{(\{0.1\}, \{0.3\}, \{0.6\}), (\{0.2, 0.4\}, \{0.6\}, \{0.7, 0.8\}), (\{0.5\}, \{0.6\}, \{0.7, 0.8\})\}$	$\{(\{0.1\}, \{0.3\}, \{0.6\}), (\{0.2, 0.4\}, \{0.6\}, \{0.7, 0.8\}), (\{0.5\}, \{0.6\}, \{0.7, 0.8\})\}$	$\{(\{0.1\}, \{0.3\}, \{0.6\}), (\{0.2, 0.4\}, \{0.6\}, \{0.7, 0.8\}), (\{0.5\}, \{0.6\}, \{0.7, 0.8\})\}$	$\{(\{0.1\}, \{0.3\}, \{0.6\}), (\{0.2, 0.4\}, \{0.6\}, \{0.7, 0.8\}), (\{0.5\}, \{0.6\}, \{0.7, 0.8\})\}$	$\{(\{0.3\}, \{0.4, 0.5\}, \{0.5, 0.6\}), (\{0.4, 0.5\}, \{0.2\}, \{0.7\}), (\{0.3\}, \{0.5\}, \{0.8\})\}$	$\{(\{0.1\}, \{0.3\}, \{0.6\}), (\{0.2, 0.4\}, \{0.6\}, \{0.7, 0.8\}), (\{0.5\}, \{0.6\}, \{0.7, 0.8\})\}$	$\{(\{0.3\}, \{0.4, 0.5\}, \{0.5, 0.6\}), (\{0.4, 0.5\}, \{0.2\}, \{0.7\}), (\{0.3\}, \{0.5\}, \{0.8\})\}$	$\{(\{0.1\}, \{0.3\}, \{0.6\}), (\{0.2, 0.4\}, \{0.6\}, \{0.7, 0.8\}), (\{0.5\}, \{0.6\}, \{0.7, 0.8\})\}$
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