

**OPEN ACCESS**

SUBMITTED 12 March 2025

ACCEPTED 08 April 2025

PUBLISHED 11 May 2025

VOLUME Vol.05 Issue05 2025

COPYRIGHT

© 2025 Original content from this work may be used under the terms of the creative commons attributes 4.0 License.

The Importance of Teaching Set Theory to Students Majoring in Information Technology

 Zulfikharov Ilkhom Makhmudovich

Associate Professor of the Department of "Information Technologies" of the Andijan State Technical Institute, Uzbekistan

Abstract: This article highlights the importance of teaching set theory to students majoring in Information Technology (IT). It analyzes the fundamental role of set theory in areas such as programming, algorithms, databases, and artificial intelligence. Furthermore, it provides scientifically grounded proposals regarding the methodology of teaching set theory and improving its effectiveness in the educational process.

Keywords: Set theory, information technology, Euler-Venn diagram, database, algorithm, programming.

Introduction: The goal of teaching mathematics is to develop the field itself, and its advancement should be directed towards solving contemporary scientific and technological problems.

It is crucial today to focus on providing future specialists studying in higher education institutions with strong professional training based on modern requirements, enabling them to become masters of their craft. The more knowledgeable and skilled the specialists are, the greater their contribution to the country's development [1].

This article was written to contribute, albeit modestly, to implementing the tasks set forth in Presidential Decrees PQ-3775 (June 5, 2018) and PQ-4708 (May 7, 2020) concerning improving the quality of education and scientific research in mathematics in Uzbekistan [1; 2].

Information technology today covers all areas of society, and success in this field requires a strong mathematical foundation. In particular, set theory plays a fundamental role in working with algorithms, data structures, and artificial intelligence systems. Set theory

serves as a principal tool for modeling and solving IT problems.

METHODOLOGY

Foreign scholars. Georg Cantor, the founder of set theory, laid the groundwork for mathematical thinking. His work on structures, order, and cardinality laid a foundation for technological reasoning. Paul Halmos simplified set theory in his book *Naive Set Theory*, making it accessible to students and enhancing essential IT skills. Kenneth Kunen showed the necessity of deep mathematical bases of set theory in developing complex structures in high-level information systems and artificial intelligence. Patrick Suppes used set theory to explain logic and information structures, especially important in database and algorithmic systems.

Uzbek scholars. M.To'ychiyev highlighted the importance of discrete mathematics and set theory in programming, algorithm construction, and forming data structures. S.Jo'rayev emphasized the fundamental role of set theory in integrating mathematical concepts with computer science, especially in developing practical programming skills through set operations (intersection, union, difference). Sh.Ismoilov analyzed the application of set theory in modeling information processes, including networks, graph theory, and algorithms.

While foreign scholars developed the theoretical and philosophical foundations of set theory in IT, Uzbek scholars have focused on strengthening its practical applications in IT education.

DISCUSSION AND RESULTS

Set theory plays a central role in the following IT fields:

- ✓ **Databases.** Set operations (union, intersection, difference) form the basic mathematical model for creating and managing databases. Relational algebra and models are based on set theory.
- ✓ **Algorithms.** Algorithmic structures like search and sorting algorithms are often built upon operations on sets.
- ✓ **Artificial Intelligence.** Creating knowledge bases and defining interrelationships between concepts relies on set theory.
- ✓ **Programming Languages.** Many languages (C++, Python, MATLAB) include features for working with sets, requiring understanding of set properties.

Teaching Recommendations for IT Students:

- ✓ **Theoretical foundation.** Explain core concepts like sets, elements, subsets, and universal sets clearly with examples.

Visualization using Euler-Venn diagrams. Use visual methods to facilitate understanding of set operations.

Practical exercises. Implement databases, algorithms, and programming assignments based on set theory.

Problem-solving. Solve programming and algorithmic problems using set operations.

Examples in Python.

1. Creating a set and adding elements.

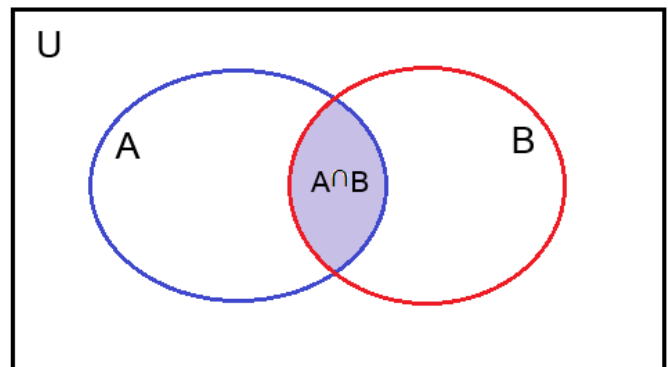
```
A = {1, 2, 3}
```

```
A.add(4)
```

```
print(A) # Result: {1, 2, 3, 4}
```

2. Union operation $A \cup B$ or $A + B$ (form 1):

$$A \cap B = \{x: x \in A \text{ and } x \in B\}.$$



form 1.

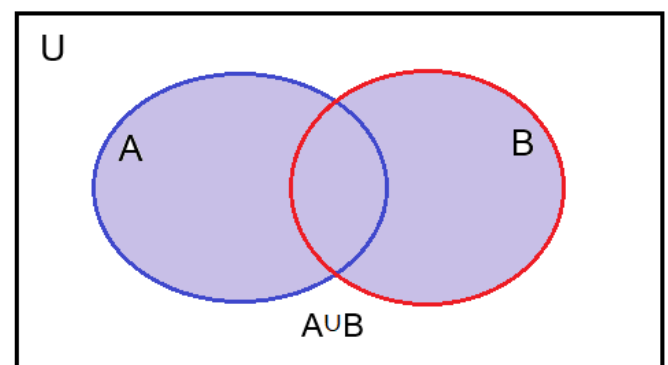
```
A = {1, 2, 3}
```

```
B = {3, 4, 5}
```

```
print(A.union(B)) # Result: {1, 2, 3, 4, 5}
```

3. Intersection operation $A \cap B$ or $A * B$ (form 2):

$$A \cup B = \{x: x \in A \text{ or } x \in B\}.$$



form 2.

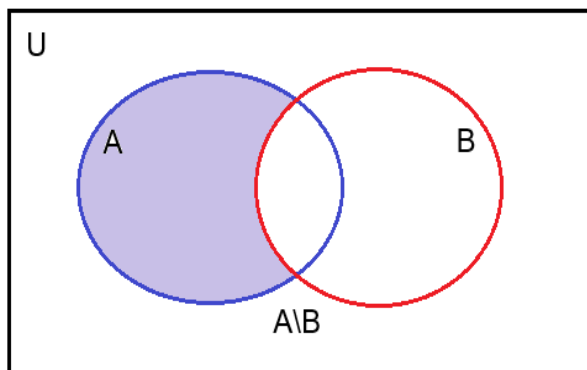
```
A = {1, 2, 3}
```

```
B = {2, 3, 4}
```

```
print(A.intersection(B)) # Result: {2, 3}
```

4. Difference $A \setminus B$ or $A - B$ (form 3):

$$A \setminus B = \{x: x \in A \text{ and } x \notin B\}.$$



form 3.

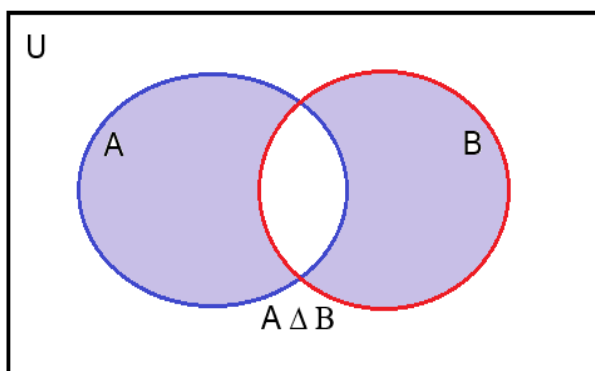
$$A = \{1, 2, 3\}$$

$$B = \{2, 3, 4\}$$

`print(A.difference(B))` # Result: {1}

5. Symmetrical division $A \Delta B$ (form 4):

$$A \Delta B = (A \setminus B) \cup (B \setminus A).$$



form 4.

$$A = \{1, 2, 3\}$$

$$B = \{2, 3, 4\}$$

`print(A.symmetric_difference(B))` # Result: {1, 4}

Experiments and scientific analysis show that students with a solid grasp of set theory:

- ✓ Make logical and precise decisions in algorithmic thinking;
- ✓ Acquire skills for writing optimal and structured code;
- ✓ Design data structures effectively;
- ✓ Achieve high levels in mathematical modeling and abstraction.

CONCLUSION

Modern IT systems' foundations - databases, algorithms, and programming - are deeply connected with the core concepts of set theory (elements, sets, operations, Cartesian products, etc.). Set theory plays a significant role in advancing IT knowledge, as

emphasized by renowned scholars. To deepen students' understanding of the integration of mathematics and IT, set theory is a vital tool for developing formal logic and abstract thinking skills.

Teach set theory through practical examples (e.g., SELECT operations in databases, search and sorting in algorithms, graph structures). Use visual tools like diagrams and simulations to simplify complex concepts. Integrate set theory with network theory and data analytics branches of IT. Guide students in creating algorithms and modeling real-world problems based on set theory. Develop modern textbooks, manuals, and electronic resources based on new-generation literature on set theory for students.

REFERENCES

O'zbekiston Respublikasi Prezidenti Sh.Mirziyoyevning 2018 yil 5 iyundagi "Oliy ta'lim muassasalarida ta'lim sifatini oshirish va ularning mamlakatda amalga oshirilayotgan keng qamrovli islohotlarda faol ishtirokini ta'minlash bo'yicha qo'shimcha chora-tadbirlar to'g'risida"gi PQ-3775-son Qarori.

O'zbekiston Respublikasi Prezidenti Sh.Mirziyoyevning 2020 yil 7 maydagi "Matematika sohasidagi ta'lim sifatini oshirish va ilmiy-tadqiqotlarni rivojlantirish chora-tadbirlari to'g'risida" PQ-4708-sonli Qaror.

Zulfixarov.I.M. Matematikadan tadbiqiy misol va masalalarni yechishda sinergetik yondashuv metodikasi. Monografiya: AndMI -2024. "Omadbek print number one" MCHJ. -119 b.

Saidakhon Atajonova, Ilkhom Zulfikharov. Improving the methodology of effective organization of mathematics courses in technical universities. Scopus. AIP Conf. Proc. 3244, 020009 (2024). RESEARCH ARTICLE | NOVEMBER 27.2024. <https://doi.org/10.1063/5.0241836>.

Zulfixarov I.M., Mamasidiqov B.Q. Sun'iy intellektni yaratishda bul algebrasining mantiqiy yo'nalishdagi matematik tahlili / Andijon mashinasozlik instituti xalqaro ilmiy – texnik anjuman. -348-350 bet. 18-19-sentabr, 2023-yil.

Zulfixarov I.M, Atajonova S.B. Methodology of Explaining to Students the Organization of Bayes Networks with Mathematical Considerations in Practical Lessons in Mathematics. Innova Science Journal of Theory, Mathematics and Physics. Vol. 3, No. 4, 2024. P 40-45.

Zulfixarov I.M, Po'latov M. In practical lessons in mathematics some economic issues through exact integral solution methodology. Misir Egept. International Journal of Engineering Mathematics, Theory and Application (Online). 1687-6156.

Zulfikharov Ilkhom Makhmudovich, Olimjonov Husanboy the son of Azamjon. The importance of mathematical logic schemes in artificial intelligence.

American Journal of Applied Science and Technology.
Vol.05 Issue01 2025. P. 36-38. DOI:
10.37547/ajast/Volume05Issue02-10.

Zulfikharov Ilkhom Makhmudovich, No'monov
Abdulazizbek the son of Shuxratjon. Principles of
operation and efficiency of bayesian networks in logic
schemes used in artificial intelligence. Misir Egept.
International Journal of Engineering Mathematics:
Theory and Application (Online). 1687-6156. VOLUME
7 ISSUE 1 p. 14-19. <http://iejemta.com/>.