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## Discrete math problems

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The text includes topics that are appropriate for that audience as well as for students planning to major in computer science. It is missing topics (e.g., binary relations) that would introduce more abstract topics that would be good for students planning to major in mathematics. The discussion of different methods of writing proofs is very good. I really liked the inclusion of proofs more than one way - I try to include that in my class as much as possible. Content Accuracy rating: 5 I did a fairly careful read through of the first four chapters of the book. I read the first few sections of the chapter on graphs but I don't include that topic in my class. I did not find any issues with the content. The text I use has a section on graphs which I'm planning to include in my class. The introduction to graphs in the Levin text is very good and I would likely use it to prepare my class discussion of this topic. Relevance/Longevity rating: 5 This text provides a good introduction to some basic topics needed for success in mathematics. The context of some of the examples might become dated over time but the topics will always be needed. The text is arranged in such a way that will allow instructors to choose the order of coverage in their class. Clarity rating: 4 The writing is very engaging and the explanations are clear. Some of the notation and topics are introduced out of order. For example, the symbol for the empty set is used before the empty set is defined. Notation for the natural numbers, real numbers, integers, etc. is not introduced until later in the text. The discussion of Pascal's Triangle was particularly interesting. I would have liked the inclusion of truth tables in the section on logic rather than later in the text. Some of the notation is non-standard (this is a big problem in mathematics overall not just with this text). Two examples are  $P(n) > n0(P(n+7))$  on page 15 (sorry I can't include not notation) and  $S(x)$  to indicate a square on page 17. Also, using codomain instead of range is unusual. Consistency rating: 4 As I indicated above, some notation and topics are included or used as examples before being formally introduced or explained. Modularity rating: 5 The chapters are organized in sections in such a way that instructors don't have to include all topics in a chapter if they are not needed. Organization/Structure/Flow rating: 5 The order of topics is different from the text that I use (Discrete Mathematics with Graph Theory by Goddairre & Parmenter) but the order in this text makes some useful connections between topics. For example, including counting topics with sets and alternate interpretations of the binomial coefficients provides an opportunity for students to see how the coefficients can be viewed or understood in different contexts. If I wanted to use this text but keep the same order as in the text I use I don't think it would be too difficult. Interface rating: 5 I had no problems with the interface. I used the pdf "find" function to see where topics were discussed or introduced and had no problems. I saw no distortion of images or missing objects. Grammatical Errors rating: 5 I did not find any grammatical issues. As the author indicated, the text has been reviewed and modified multiple times, so I'm not surprised by this. Cultural Relevance rating: 4 The only issue I can think of is the use of male and female names in some examples, which might not be inclusive of non-gendered or alternately gendered individuals. If it is possible to rewrite examples and questions without using a context that include names, that would be good. Comments I didn't like some of the example used in the Investigate! questions. I stopped reading them after a while. I wouldn't use them in a college level course, but maybe they are good for middle and high school teachers. I liked the discussion of similarity between set notation and logic notation and the use of logic notation to define set notation but De Morgan's Laws for sets is missing. I also liked the inclusion of recursively defined functions with the discussion of functions. This topic is covered later on in the text I use but I think recursion is an important topic to include. Reviewed by Nachimuthu Manickam, Professor, DePauw University on 12/18/20 This book covers all the important topics such as set theory, logic, counting techniques, number theory, graph theory etc. These are the topics normally covered in any typical discrete math course. The "investigate" part for each concept is an... read more Reviewed by Nachimuthu Manickam, Professor, DePauw University on 12/18/20 Comprehensiveness rating: 5 see less This book covers all the important topics such as set theory, logic, counting techniques, number theory, graph theory etc. These are the topics normally covered in any typical discrete math course. The "investigate" part for each concept is an excellent approach. It provides a good motivation for the topic that is going to be covered. Many of my students liked this approach. I used this book for my course on "Computational Discrete Mathematics". My students also liked the fact that they did not have to pay any money to use the book. Discrete Math is usually the first course where the students come across theorems and proofs. Many students find them to be hard to comprehend. However, the approach taken by this author is excellent. He goes through the proofs in much more details than most of the other books on this topic. This really helps the students to understand the material well. It is preparing the students to take more proof intensive courses such as Linear Algebra. Content Accuracy rating: 5 I did not find any mistake in the book. A very well edited book. Relevance/Longevity rating: 5 Discrete Math has applications in many areas including computer science, economics, etc. The topics covered in this book have been in existence for a long time and I cannot imagine them to become isolate ever. Clarity rating: 5 It is a very well written book. The examples provided are very relevant to the topics covered. The author has provided solutions to several problems in the exercises. I like the part where you can just click on the problem to go to the solution and vice versa. Consistency rating: 5 I don't see any problem with consistency Modularity rating: 5 Since discrete math is composed of several independent topics, usually there is not much of an issue with the arrangement of the topics. However, please note my comment on organization/Structure/Flow rating: 4 The chapters are very well organized. However, I would prefer the number theory chapter to appear earlier in the book so that the number theory concepts and examples can be used throughout the book. When I introduced equivalence relations to my students, I had to explain the congruence relations (to provide a good example) before we covered the number theory chapter. Interface rating: 5 This is the part I very much like in the book. One can easily move from one part of the book to another. The figures drawn to illustrate graphs etc. are appropriate. Grammatical Errors rating: 5 None Cultural Relevance rating: 5 It is a math book! Math books are neutral to all cultures! Comments It is a well written book. The book is geared more towards math majors than non majors. When I used this book in my computational discrete math course, I had to supplement it with several handouts. I am looking forward to use it in my regular discrete math course meant for math majors. Overall, I am glad that I came across this book. Reviewed by John Salisbury, Adjunct Instructor, Rogue Community College on 8/25/20 I have not taken discrete mathematics so I am not sure what all the areas are but it's over 400 pages long and seems to cover in good depth the topics that it covers. It appears to have a comprehensive index and it also has a "list of symbols"... read more Reviewed by John Salisbury, Adjunct Instructor, Rogue Community College on 8/25/20 Comprehensiveness rating: 4 see less I have not taken discrete mathematics so I am not sure what all the areas are but it's over 400 pages long and seems to cover in good depth the topics that it covers. It appears to have a comprehensive index and it also has a "list of symbols" which I would imagine would be very helpful. Content Accuracy rating: 3 If we accept the proposition that a book on discrete math needs to be inclusive of a variety of races, ethnicities, and backgrounds, the book may fall short on that count. I will say that I found nothing culturally insensitive or offensive in any way in the text. It might make book more interesting to the reader and arresting of his attention if more exotic examples from different lands and cultures were included. It could broaden the reader's mind. Comments I wish I had time to take Professor's Levin's class and study the book intensively. Reviewed by Elena Braynova, Professor, Worcester State University on 6/30/20 Almost every CS program requires students to take a Discrete Mathematics course. The textbook covers most of the topics usually discussed in a Discrete Mathematics course such as Counting Techniques, Recurrence Relations, Set Theory, Logic, Graph... read more Reviewed by Elena Braynova, Professor, Worcester State University on 6/30/20 Comprehensiveness rating: 5 see less Almost every CS program requires students to take a Discrete Mathematics course. The textbook covers most of the topics usually discussed in a Discrete Mathematics course such as Counting Techniques, Recurrence Relations, Set Theory, Logic, Graph Theory. There is a short section on Number Theory, too. The textbook Index has links to pages where a particular concept/technique is discussed. It replaces a Glossary. List of symbols contains basic notation used in the textbook with the links to corresponding pages. Both versions, pdf and online version of the textbook have an easy and good navigation. Content Accuracy rating: 5 The text is accurate and unbiased. I did not find any errors Relevance/Longevity rating: 5 The text is relevant in its content and examples. Mathematical concepts and techniques covered in the textbook will only become more relevant in applications. Clarity rating: 5 The text is readable and straightforward. The textbook examples are simple enough and clearly illustrate discussed mathematical concepts. Each section starts with "Investigate" questions that engage and encourage students to participate in a topic discussion. Consistency rating: 5 The text is consistent. Terms, concepts, notations are used consistently throughout the textbook. Modularity rating: 5 The modularity of the text is appropriate. The content is organized by major topics/chapters (Counting, Sequences, ...). Each chapter is broken into sections. The topics are not connected and can be used in any order as well as be remixed with any additional resources. Organization/Structure/Flow rating: 5 The chapters are well organized. Each chapter starts with "Investigate" questions that initiates discussion. Concept definitions and techniques descriptions are followed by examples illustrating them. There is a set of exercises at the end of each section. Interface rating: 4 There are just a few images in the text. Graphics used to illustrate set operations and graph theory concepts are well laid out. Some tree and Venn diagrams might be improved. Grammatical Errors rating: 5 I did not notice grammatical errors. If there are any, they probably are just a few. Cultural Relevance rating: 5 I agree with the other reviewers. The textbook is as culturally relevant as a math textbook could be. Comments I'd like to thank Dr. Oscar Levin for writing this textbook and contributing to open educational resources. The text is very readable and engaging, with excellent examples and very good exercises. I consider using some of the chapters as additional resource in my Discrete Mathematics courses. Reviewed by John Salisbury, Mathematics Instructor, Rogue Community College on 4/11/17 There are many topics in discrete mathematics. This book does a fine job of covering numerous topics in this area, including among several other topics, symbolic logic, counting, sets, and a short section on number theory. There is very good index that links to pages in the text. I did not find a glossary, but because the index links to the text, that is not really necessary. There is clearly enough material here for a very meaty undergraduate course. Content Accuracy rating: 5 I found no errors in the text and found no bias of any kind in the text. Relevance/Longevity rating: 5 This subject is essentially timeless because the principles are mathematical and will always be true and valid. There is one problem involving Continental Airlines that no longer exists, but that is a minor quibble. This does not make the text obsolete. Clarity rating: 5 This is the book's strongest suit. It is written in an upbeat enthusiastic style that comes through. The reader can tell that the author is an energetic teacher who genuinely enjoys the subject. The prose is clear and inviting to the reader. The "Investigate!" sections at the beginning of each lesson are designed to and do pique the student's curiosity. Consistency rating: 5 There are no problems here at all. The book uses terms and concepts consistently throughout the book/ Modularity rating: 4 Actually I think the book could be improved with more headings and subheadings to help the reader understand where the next paragraph or section is going. Since the topics do not necessarily build on one another, I think it would be possible to reorganize the text to build a course which would deal only with selected topics. There is not excessive self-reference within the book. I think an instructor would be able to pick and choose among the topics without much trouble. Organization/Structure/Flow rating: 5 All topics are introduced by an "Investigate!" section which has the reader puzzle over a problem or set of problems. These "Investigate!" sections are tremendous and whet the reader's appetite for what follows. The problems are of varying degrees of difficulty and many are quite thought provoking. The book has a nice logical flow. Interface rating: 4 Some modern textbooks have many more pictures, sidebars, and bells and whistles. This book does not have a lot of that, but the limited numbers of illustrations are clear and do not confuse the reader. The links from the index are excellent. This reviewer tends to think that a lot of textbooks simply distract the reader with all of the pictures and sidebars. The book has a simple clear interface. It is not a fancy book and it does not need to be. Grammatical Errors rating: 5 I found no grammar errors. Cultural Relevance rating: 3 The book is not culturally insensitive or offensive in any way. I note that one of the problems refers to a Christmas party. Maybe there should be references to other religious parties or traditions, it is a math book about discrete mathematics so it is difficult to work in examples that include other races, ethnicities or backgrounds, but with a little creativity such examples could probably be included. Comments The best thing about this book is the clear tone of enthusiasm for the subject that comes through loud and clear. The tone is infectious and I found myself as I read the book feeling as if I were in a lecture hall attentively listening to the author, Oscar Levin. There is an informality to the book which does not sacrifice any rigor. This is a definite plus. I was very impressed with this book. Reviewed by Namita Sarawagi, Associate Professor, Rhode Island College on 4/11/17 This textbook, "Discrete Mathematics: An Open Introduction", by Oscar Levin, provides a good overview of topics in Discrete Mathematics. The primary focus of this text is not to provide a rigorous mathematical foundation for Computer Science... read more Reviewed by Namita Sarawagi, Associate Professor, Rhode Island College on 4/11/17 Comprehensiveness rating: 5 see less This textbook, "Discrete Mathematics: An Open Introduction", by Oscar Levin, provides a good overview of topics in Discrete Mathematics. The primary focus of this text is not to provide a rigorous mathematical foundation for Computer Science; instead, it is targeted towards first and second year undergraduate math majors who will go on to teach middle school and high school mathematics. The text starts with a brief but useful introduction to mathematical concepts (mathematical statements, sets and functions), and then goes on to cover a range of topics in depth, broken up into four main sections: Combinatorics, Sequences, Symbolic Logic and Graph Theory, as well as an Additional Topics section that touches on Generating Functions and provides an introduction to Number Theory. The material touches on a wide array of concepts such as the Pigeonhole principle. The text has several features that I found quite innovative and helpful. The presentation takes an inquiry-based approach, and most topics start with an "Investigate!" section that poses a number of questions or problems to help motivate students to understand the context for the topic they're about to start - for example, the Combinatorial Proofs topic is preceded by an Investigate! Section that uses the Stanley cup tournament rules to make students think about how many ways a team can win, and how to generalize the problem space. The text also approaches mathematical proofs in a friendly, non-intimidating manner and provides different approaches to proving a given identity or theorem, helping students to broaden their mathematical toolkit. The text has a comprehensive index, and has both a PDF version and a well-designed interactive online format, with a contents tab and expandable solutions (allowing students to attempt a question before unveiling the solution). Content Accuracy rating: 5 The material in the book was well-edited and proof-read. I didn't encounter obvious mistakes or omissions in my first reading of the text, and only a few typos (e.g. "bijective"). Relevance/Longevity rating: 5 The content of this text is relevant to current undergraduate courses in Discrete Mathematics, particularly for those students intending to pursue careers in middle and high school education. The topics are of fundamental, enduring importance, and not subject to obsolescence. Clarity rating: 5 The author writes clearly and successfully manages to make the subject material approachable, interesting and comprehensible, while not shirking from exploring the more complex aspects of each topic. Mathematical proofs are exceptionally well explained, focusing on helping students understand why an identity is true rather than merely the mechanical aspects of stepping through a number of steps in a proof that may lead to losing sight of the forest for the trees. There are a few places where additional editing might improve clarity, but overall, the quality of the writing is commendable. Consistency rating: 5 The text is well organized and structured, the terminology used is consistent and pedagogically sound, and the overall presentation is designed so that students find that each topic is presented in a logical, evolutionary manner. Modularity rating: 5 Within the constraints of the subject matter, where topics frequently require understanding of preceding concepts, the text is organized in a reasonably modular fashion. The online interactive format is particularly engaging and likely, in my opinion, to be found useful by students. Organization/Structure/Flow rating: 5 The text is well organized and structured, allowing the material to flow and be built up in an accessible manner. The use of the introductory Investigate! sections throughout the text is an excellent tool to motivate students to think about topics before getting into the details. Interface rating: 5 The book's design and interface is well-thought-out, particularly the interactive online version, which is cleanly designed, non-distracting, functional and approachable, with simple and straight-forward navigational controls. Grammatical Errors rating: 5 I found the writing to be high-quality, well-proofed, and free of grammatical issues. Cultural Relevance rating: 5 Given the nature of the text's material, cultural relevance is not a major concern. However, the examples used in the text appeared to be appropriate, without any cultural or gender stereo-typing. Comments I found this text to be well written and structured, and will be considering using it as the text for a Discrete Mathematics course that I teach. 0 Introduction and Preliminaries 1.0 1 What is Discrete Mathematics? 0.2 2 Mathematical Statements 0.3 Sets 1 Counting 1.1 Additive and Multiplicative Principles 1.2 Binomial Coefficients 1.3 Combinations and Permutations 1.4 Combinatorial Proofs 1.5 Stars and Bars 1.6 Advanced Counting Using PIE 1.7 Chapter Summary 2 Sequences 2.1 Definitions 2.2 Arithmetic and Geometric Sequences 2.3 Polynomial Fitting 2.4 Solving Recurrence Relations 2.5 Induction 2.6 Chapter Summary 3 Symbolic Logic and Proofs 3.1 Propositional Logic 3.2 Proofs 3.3 Chapter Summary 4 Graph Theory 4.1 Definitions 4.2 Trees 4.3 Planar Graphs 4.4 Coloring 4.5 Euler Paths and Circuits 4.6 Matching in Bipartite Graphs 4.7 Chapter Summary 5 Additional Topics 5.1 Generating Functions 5.2 Introduction to Number Theory Ancillary materials are available by contacting the author or publisher. Discrete Mathematics: An Open Introduction is a free, open source textbook appropriate for a first or second year undergraduate course for math majors, especially those who will go on to teach. The textbook has been developed while teaching the Discrete Mathematics course at the University of Northern Colorado. Primitive versions were used as the primary textbook for that course since Spring 2013, and have been used by other instructors as a free additional resource. Since then it has been used as the primary text for this course at UNC, as well as at other institutions. Oscar Levin is an Associate Professor at the University of Northern Colorado in the School of Mathematical Sciences. He has taught mathematics at the college level for over 10 years and has received multiple teaching awards. He received his Ph.D. in mathematics from the University of Connecticut in 2009. Suggest an edit to this book record The Discrete Mathematics questions and answers will help students quickly grasp almost all of the concepts discussed in "Discrete Mathematics." Students can use these questions to quickly understand the concept. We have also included some practice questions so they can understand better. Furthermore, you can get thorough explanations for every question and cross-check your answers. Click here to read more about discrete mathematics. Discrete Mathematics Questions with Solutions Introduction to Discrete Mathematics: The field of mathematics known as discrete mathematics is concerned with the study of discrete mathematical structure. There are two different types of data: discrete and continuous. Instead of studying continuous data, discrete mathematics examines discrete data. Finite mathematics is another name for it. Discrete mathematics includes some important concepts such as logic, sequences and series, set theory, graph theory, permutation, induction, combinations, etc. 1. If a set B has n elements, then what is the total number of subsets of B. Justify your answer. Solution: If a set B has "n" elements, then the total number of subsets of B is 2^n. For example, if B contains 5 elements, say B = {1, 2, 3, 4, 5}, then the total number of subsets of B is 2^5 = 32. 2. If X and Y are the two finite sets, such that n(X U Y) = 36, n(X) = 20, n(Y) = 28, then find n(X ∩ Y). Solution: Given: n(X) = 20, n(Y) = 28, n(X U Y) = 36. As we had, n(X U Y) = n(X) + n(Y) - n(X ∩ Y) On rearranging the above formula, we get; n(X ∩ Y) = n(X) + n(Y) - n(X U Y) Now, substitute the given values in the above formula, we get; n(X ∩ Y) = 20 + 28 - 36 n(X ∩ Y) = 48 - 36 n(X ∩ Y) = 12. Hence, n(X ∩ Y) is 12. 3. In a group of 100 students, 72 students can speak English and 43 students can speak Hindi. Based on these data, answer the following questions: Find the number of students who can speak English only. Find the number of students who can speak Hindi only. Find the number of students who can speak both English and Hindi. Solution: Let E be the set of students who speak English, and H be the set of students who speak Hindi. Thus, from the given conditions, we get n(E) = 72 n(H) = 43 n(E∪H) = 100 Using the formula n(A ∪ B) = n(A) + n(B) - n(A ∩ B), we can write; n(E ∪ H) = n(E) + n(H) - n(E ∩ H) ...(1) Finding Number of students who can speak both English and Hindi: Rearranging the formula (1), we get n(E ∩ H) = n(E) + n(H) - n(E ∪ H) Now, substitute the known values in the above equation, we get n(E ∩ H) = 72 + 43 - 100 n(E ∩ H) = 15. Therefore, the number of students who can speak both English and Hindi is 15. Finding Number of students who speak English only: n(E - H) = n(E) - n(E ∩ H) Thus, n(E - H) = 72 - 15 n(E - H) = 57. Hence, the number of students who speak English only is 57. Finding Number of students who speak Hindi only: n(H - E) = n(H) - n(E ∩ H) n(H - E) = 43 - 15 n(H - E) = 28. Therefore, the number of students who speak Hindi only is 28. Also, read: Sets. 4. Find the missing number in the sequence: 5, 10, 15, \_\_\_\_\_, 25, 30. Solution: Given sequence: 5, 10, 15, \_\_\_\_\_, 25, 30. In the given sequence, each preceding term is added with 5 to get the succeeding term. I.e., 5 + 5 = 10 10 + 5 = 15 15 + 5 = 20 20 + 5 = 25 25 + 5 = 30. Hence, the missing term in the given sequence is 20. Therefore, the complete sequence is 5, 10, 15, 20, 25, 30, 5. Determine the missing term in the sequence: 4, 12, \_\_\_\_\_, 108, 324, 972. Solution: Given Sequence: 4, 12, \_\_\_\_\_, 108, 324, 972. In the given sequence, each succeeding term is obtained by multiplying 3 to its previous term. I.e., 4 × 3 = 12 12 × 3 = 36 36 × 3 = 108 108 × 3 = 324 324 × 3 = 972. Hence, the missing term in the given sequence is 36. Thus, the complete sequence is 4, 12, 36, 108, 324, 972. Also, read: Sequence and Series. 6. Calculate the tenth term of the Arithmetic Progression 13, 8, 3, -2,...? Solution: Given AP: 13, 8, 3, -2,... Here, the first term, a = 13 Common difference, d = -5. I.e., d = 8 - 13 = -5, 3 - 8 = -5, -2 - 3 = -5. And, n = 10. The formula to find the nth term of Arithmetic Progression is Tn = a + (n-1)d Now, substitute the given value in the formula, we get T10 = 13 + (10 - 1)(-5) T10 = 13 + (9)(-5) T10 = 13 - 45 T10 = -32 Hence, the tenth term of given Arithmetic Progression 13, 8, 3, -2,... is -32. 7. In a group of students, there are 6 boys and 4 girls. Out of 10 students, 4 students have to be selected. Find out how many different ways the students can be selected such that at least one boy should be selected? Solution: Total number of students = 10 Number of boys = 6 Number of girls = 4. So, here we have to select 4 students. In that, at least one boy should be selected. Hence, there are four cases: Case 1: All four students are boys: Thus, the number of ways = 6C4 = 15 Case 2: 3 Boys and 1 girl are selected: The number of ways to select 3 boys and 1 girl = 6C3 × 4C1 = 20 × 4 = 80. Case 3: 2 boys and 2 girls are selected: The number of ways to select 2 boys and 2 girls = 6C2 × 4C2 = 15 × 6 = 90. Case 4: 1 boy and 3 girls are selected: The number of ways to select 1 boy and 3 girls = 6C1 × 4C3 = 6 × 4 = 24. Therefore, the number of ways to select 4 students such that at least one boy to be selected = 15 + 80 + 90 + 24 = 209. 8. Find out the number of ways that the letters of the word "LEADER" can be arranged? Solution: In the word "LEADER", there are 6 letters. In that, E is repeated twice. Hence, the total number of ways that the letters can be arranged = 6!/2! = 720/2 = 360. 9. Find out the number of ways that the letters of the word "DETAIL" can be arranged such that the vowels must occupy odd positions. Solution: In the word "DETAIL", there are 6 letters. In that, there are 3 vowels (E, A, I), and 3 consonants (D, T, L). According to the given question, the vowels must occupy odd positions. So, first, mark the positions of the letters as 1, 2, 3, 4, 5, and 6. As per the questions, vowels should occupy positions 1, 3, and 5. Hence, the number of ways to arrange the vowels = 3P3 = 6. So, the number of ways to arrange the consonants in the remaining positions = 3P3 = 6. Therefore, the number of ways to arrange the letters = 6 × 6 = 36. Also, read: Permutations and Combinations. 10. Simplify the expression (x + y)(x + z) using the laws of boolean algebra. Solution: Let Q = (x + y)(x + z) Using the distributive law, we can write: Q = xx + xz + yx + yz. By applying the idempotent law A.A = A. Q = x + xz + yx + yz Q = x(1 + z) + yx + yz (Using distributive law) Applying identity OR law (1 + A = 1), we can write Q = x. 1 + yx + yz Q = x + yx + yz. Again using the distributive law, we get Q = x. (1 + y) + yz Q = x. 1 + yz (By applying identity OR Law) Q = x + yz. Therefore, the simplification of the expression (x + y)(x + z) is x + yz. Explore More Articles Practice Questions Solve the following discrete mathematics questions: If U = {2, 4, 6, 8, 10, 12, 14, 16}, A = {2, 6, 10} and B = {4, 8, 10, 12, 14, 16}, then find A - B B - A A ∩ B 2. Find out the number of ways that 3 postcards can be posted in 5 post boxes. 3. Simplify the boolean expression: A = XY + X (Y+Z) + Y(Y+Z). To learn more interesting Maths concepts, visit BJU'S - The Learning App and download the app today!