Timberlane Regional High School

Summer Packet 2019-2020

The purpose of this summer work is to help prepare you for your upcoming math class. The work will tap into your prior knowledge and help you to begin making connections between past content, concepts, and skills and those that are part of the formal study of discrete mathematics.

This summer work will be ***due on*** **Thursday, September 5th and Friday, September 6th,** and will be 3% of your first quarter grade. 10 points will be deducted for each day it is late. The packet will be graded as follows:

Summer Work Assignments	Grading	Evidence	Perseverance
Read the included text and answer the guided reading questions.	10 points will be awarded for each complete answer.	Students will write each answer as a brief paragraph. The answer will reflect understanding of the reading and thoughtful consideration of the question.	Students can develop further clarification as needed using Google searches or by contacting me at the school Mon-Thursday, as I am in the office most of the summer.
Provide one example problem for each of the 6 themes listed in the reading.	10 points will be awarded for each example.	Students will provide a written example of a problem (*not the solution*) for each theme. They will be labeled by theme.	Students can develop further clarification as needed using Google searches or by contacting me at the school Mon-Thursday.

A note from your discrete teacher:

My hope is that this summer work creates an understanding of what our work will include this year. I am looking forward to exploring the themes of discrete mathematics with you! This will be unlike any math class you have ever taken.

Themes of a Discrete Mathematics Course

Discrete mathematics describes processes that consist of a sequence of individual steps. This contrasts with calculus, which describes processes that change in a continuous fashion. Whereas the ideas of calculus were fundamental to the science and technology of the industrial revolution, the ideas of discrete mathematics underlie the science and technology of the computer age. The main themes of a first course in discrete mathematics are logic and proof, induction and recursion, discrete structures, combinatorics and discrete probability, algorithms and their analysis, and applications and modeling.

Logic and Proof

Probably the most important goal of a first course in discrete mathematics is to help students develop the ability to think abstractly. This means learning to use logically valid forms of argument and avoid common logical errors, appreciating what it means to reason from definitions, knowing how to use both direct and indirect argument to derive new results from those already known to be true, and being able to work with symbolic representations as if they were concrete objects.

Induction and Recursion

An exciting development of recent years has been the increased appreciation for the power and beauty of "recursive thinking." To think recursively means to address a problem by assuming that similar problems of a smaller nature have already been solved and figuring out how to put those solutions together to solve the larger problem. Such thinking is widely used in the analysis of algorithms, where recurrence relations that result from recursive thinking often give rise to formulas that are verified by mathematical induction.

Discrete Structures

Discrete mathematical structures are the abstract structures that describe, categorize, and reveal the underlying relationships among discrete mathematical objects. Those studied in this book are the sets of integers and rational numbers, general sets, Boolean algebras, functions, relations, graphs and trees, formal languages and regular expressions, and finite-state automata.

Combinatorics and Discrete Probability

Combinatorics is the mathematics of counting and arranging objects, and probability is the study of laws concerning the measurement of random or chance events. Discrete probability focuses on situations involving discrete sets of objects, such as finding the likelihood of obtaining a certain number of heads when an unbiased coin is tossed a certain number of times. Skill in using combinatorics and probability is needed in almost every discipline where mathematics is applied, from economics to biology, to computer science, to chemistry and physics, to business management.

Algorithms and Their Analysis

The word algorithm was largely unknown in the middle of the twentieth century, yet now it is one of the first words encountered in the study of computer science. To solve a problem on a computer, it is necessary to find an algorithm or step-by-step sequence of instructions for the computer to follow. Designing an algorithm requires an understanding of the mathematics underlying the problem to be solved. Determining whether or not an algorithm is correct requires a sophisticated use of mathematical induction. Calculating the amount of time or memory space the algorithm will need in order to compare it to other algorithms that produce the same output requires knowledge of combinatorics, recurrence relations, functions, and O-, -, and -notations.

Applications and Modeling

Mathematical topics are best understood when they are seen in a variety of contexts and used to solve problems in a broad range of applied situations. One of the profound lessons of mathematics is that the same mathematical model can be used to solve problems in situations that appear superficially to be totally dissimilar. A goal of this book is to show students the extraordinary practical utility of some very abstract mathematical ideas.

Above text taken from:

Epp, Susanna S. Preface. Discrete Mathematics with Applications. 4th ed. Belmont, CA: Thomson-Brooks/Cole, 2004. Xiv-Xv. Print.

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Summer Assignment: Answers these questions on a separate sheet of paper using brief paragraphs:

1. In what ways do you expect Discrete Mathematics to be different from the other math classes you have taken in high school?

2. What themes have you studied previously that seem to also be a part of this course?

3. Are there themes you have never studies in other courses? What are your expectations around these specific themes?

4. What is your favorite structure for a math lesson? Please consider characteristics such as: lecture style, discovery lesson, readings, group work, seminar, workshop, presentations, student-led, and teacher-led. Be sure to explain why your description works for you as a learner.

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5. Provide a written example of ONE sample problem for each theme. (Total of 6 problems) You may have to look these up in a textbook or online. You do NOT need to provide the solution.

Good luck! If you have any questions, please email me at james.shivell@timberlane.net