Information sheet for Math 309 Winter 2019

Class meets: MTRF 10:00 - 10:50 am in BH 415

Instructor: Branko Ćurgus **Office:** BH 178 **Office hours:** MTRF 1:00-1:50 pm **Email:** `curgus@wwu.edu`

Course website: `http://faculty.wwu.edu/curgus/Courses/309_201910/309.html`

Text: *Discrete Mathematics and Its Applications*, Fifth Edition, by Kenneth H. Rosen

Material covered: A selection of topics from Chapters 1-8 will be covered.

Subject. Discrete mathematics is an umbrella term for several different branches of mathematics. These branches are: mathematical logic, set theory, combinatorics, graph theory, number theory, discrete probability and several others. The unifying feature of these branches is that they do not require the concept of continuity which is essential in calculus. Sometimes the adjective discrete is used in mathematics as a near antonym of continuous. In calculus we study real numbers. The simplest way to visualize real numbers is the real number line. This visualization emphasizes the fact that there are no holes between real numbers: they form a continuum. In contrast, the discrete mathematics studies mathematical objects that do not have this property. The most prominent example is the set of positive integers: $1, 2, 3, \ldots$. Other examples are sets that can be in some way represented by positive integers. Throughout our study of discrete mathematics methods of mathematical proof will be emphasized and you will learn how to construct your own proofs.

Exams: There will be two “mid-term” exams and a comprehensive final exam. The dates for the “mid-term” exams are Monday, February 4 and Monday, March 4. The final exam is scheduled for *three hours* on Monday, March 18 from 8am to 11am. There will be no make-up exams. If you are unable to take an exam for a very serious reason verified in writing, please see me beforehand. This does not apply to the final exam which cannot be taken neither early nor late.

Assignments: There will be two written homework assignments. An assignment will be due one week after it has been handed out. These assignment will be graded and the grade will count towards the final grade.

Homework: A list of suggested homework problems will be posted daily on the class website. Homework will not be collected. To succeed in class you should do each problem on your own. While working on problems you should recognize which theoretical tools are being used to solve a particular problem. As a result you will acquire general problem solving strategies, which is one of the goals of higher education. Incidentally, this will also lead to your success on exams.

Grading: Each exam and assignment will be graded by an integer between 0 and 100. Your final grade will be determined using the following formula

$$\texttt{FG} = \lceil \texttt{0.2*E1 + 0.2*E2 + 0.1*A1 + 0.1*A2 + 0.4*FE} \rceil.$$

where `E1, E2` are the grades on the in-class exams, `A1, A2` are the grades on the assignments and `FE` is the grade for the final exam. In the above formula the symbol $\lceil x \rceil$ denotes the ceiling of a real number x. Your letter grade will be assigned according to the following table:

F : 0 - 49	D : 50 - 54	C− : 55 - 59	C : 60 - 64	C+ : 65 - 69
B− : 70 - 74	B : 75 - 79	B+ : 80 - 84	A− : 85 - 89	A : 90 - 100

This course is a fast-paced course. A lot of new concepts will be introduced. It takes time to internalize these concepts. Therefore it is essential that you keep up with the material presented every day; do the homework problems; look for help if you encounter difficulties.

How to succeed: Doing well in mathematics depends on understanding not memorizing. Exercise critical thinking while reading the text and doing the problems. Understanding cannot be achieved through superficial studying. Talking to other students is a good way to check your understanding. If you feel that you are not on your way to understanding the material do not hesitate to ask questions. Use the Math Center in BH 211A. I will be glad to talk to you during my office hours, or you can make an appointment.

Student learning outcomes: By the end of this class, a successful student will demonstrate: (1) the understanding of compound propositions: the negation, conjunction, disjunction, exclusive disjunction, implication and biconditional; in particular how to form the negation, the contrapositive, the converse and the inverse of an implication; (2) the ability to prove tautologies, contradictions and logical equivalences using truth tables; (3) the understanding of propositions involving the universal quantifier and the existential quantifier, in particular how to work with nested quantifiers how to state negations, how to recognize and justify whether such a proposition is true or false and justify; (4) the knowledge of the most important rules of inference: modus ponens, modus tollens, hypothetical syllogism, disjunctive syllogism and the rules of inference for quantified statements; (5) the ability to translate English sentences into logical propositions; (6) the ability to use basic methods of proof to prove propositions about odd and even integers, and rational and irrational numbers; (7) the understanding of the concept of a set, equality of sets, the concept of a subset, the empty set, cardinality of a finite set, the power set, Cartesian product of sets, including different set notations, set builder notation, use of ellipses, Venn diagrams; (8) the understanding of the set operations: intersection, union, set difference, complement, symmetric difference, and the corresponding set identities and the ability to prove set identities using involving these operations; (9) the understanding of the formal definition of a function and the concepts of domain, codomain and range, the related definitions of a surjection, an injection and a bijection and the ability to recognize and prove whether a given function satisfies these definitions; (10) the understanding of the concept of composition of functions and the inverse function; (11) the understanding of the basic properties of the floor and the ceiling and how to use them to solve related exercises; (12) the knowledge of the Axioms of the Integers and how to use them to prove the basic propositions about the integers including the Principle of Mathematical Induction; (13) the ability to prove and use in exercises the formulas for the sum of an arithmetic and the sum a geometric progression; (14) the ability to do proofs involving both versions of the Principle of Mathematical Induction (15) the understanding of recursive definitions and ability to do proofs involving recursively defined functions; (16) the ability to find closed form solution of some recursive sequences given by linear second-order nonhomogeneous recursions; (17) the understanding of the basic counting principles and how to apply them to accurately count various sets; (18) the ability to apply the Pigeonhole principle in various situations including Proof of Dirichelt's Approximation Theorem; (19) the ability to use permutations and combinations to count various sets; (20) the knowledge of basic identities involving permutations and combinations and how to prove them using algebraic and combinatorial methods; (21) the knowledge of generalized permutations and combinations and the ability to use them to count combinations and permutations with repetition; (23) the ability to use recursively defined sequences for counting.