

Discrete Structures

Fight for Survival

Dr. Mudassir Shabbir

August 27, 2026



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About Your Instructor

- Hi there! I'm Dr. Mudassir Shabbir.
- You can either call me Dr. Mudassir or you can call me Professor or just Mudassir.
- I did my Ph.D. (and M.S.) in computer science from Rutgers University in NJ, USA in 2014.
- My area of research is Discrete Mathematics, Graph Neural Networks, and Discrete Geometry.
- Most recently, I was Research Assistant Professor at Vanderbilt University, Nashville, TN.



About Your Instructor

- Email: chair.cs@itu.edu.pk. **ALWAYS** write **Discrete Structures** in the subject line alongwith the main subject matter. 
- Email: **ALWAYS** introduce yourself in the beginning of the email.
- Office Hours: An hour after class (make sure you have an **appointment**).
- Office Location: 6th floor

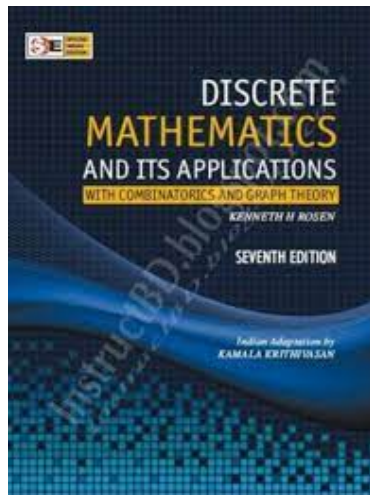
Rules of the Game

- Turn off your phones and other electronic stuff.
- Be on Time.
- No whispering; talk to me instead.
- Be honest.
- Be courteous in the class.



Textbook

- Title: Discrete Mathematics and Its Applications
- Author: Kenneth H. Rosen
- Edition: 7th Edition
- Publisher: McGraw-Hill
- ISBN-13: 978-0073383095
- A few copies are available in the library!



Google Classroom

- We will use **Google Classroom** as our online platform. Code: **a2u3oe2**
- Class materials, assignments, and assessments will be posted there.
- Stay updated by checking Google Classroom regularly.
- Post your introduction for **2 points towards Quiz1** - at min. three sentences: a name, a surprising fact about you, and what you learnt in the first class. (Only valid for today.)
- If you have any questions (or answers), feel free to ask (and answer) on the classroom.



Grading 100

Component	Weight
Homework Assignments (4 @ 0% each)	0%
Quizzes (about 20)	40%
Final Exam	30%
Midterm Exam	15%
Classroom Worksheets	6%
Group Tasks	6%
Classroom Participation	3%
Total	100%

Grading Scale

The following table should only give you an idea of a **typical grade distribution**. Note that final cutoff points will be determined at the end of the semester.

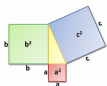
Average	Assigned Grade
≥ 90	A category
80 – 89.9	B category
70 – 79.9	C category
60 – 69.9	D category
< 60	F

What is this Course About?

Discrete + Structures



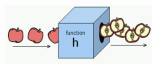
Logic



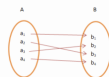
Proofs



Sets



Functions



Binary
Relations



Computation



Induction



Integer
Properties

$$\binom{n}{k} = \frac{n!}{k!(n-k)!}$$

Counting



Graphs & Trees

Applications of Discrete Structures

- Example: Company wants to **market a new product**, say a cell phone.
- Strategy: Give away **free cell phones** to **few individuals**, who will in turn advertise the product to their friends.
- Goal: Give away **minimum number of cell phones**, while ensuring that the whole community knows about the phone.



Applications of Discrete Structures

- Example: Company wants to **market a new product**, say a cell phone.
- Strategy: Give away **free cell phones** to **few individuals**, who will in turn advertise the product to their friends.
- Goal: Give away **minimum number of cell phones**, while ensuring that the whole community knows about the phone.

Is this a Discrete Math problem?

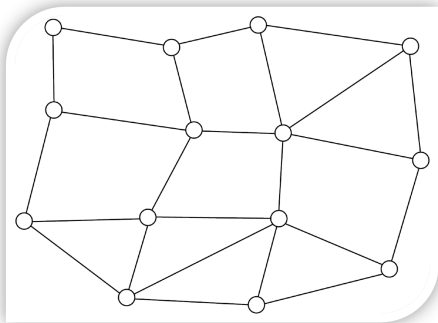
If yes, where are

- Graphs?
- Computation?
- Counting?
- Sets?
- Proofs?



Applications of Discrete Structures

- **Question:** How can we model individuals and their friendships?

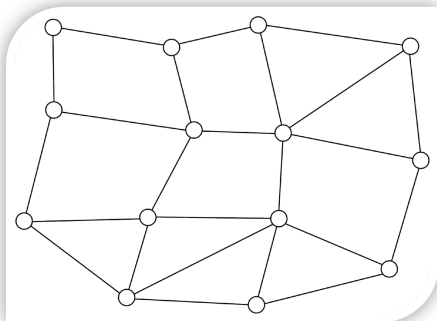


Applications of Discrete Structures

- **Question:** How can we model individuals and their friendships?
- We can use **graphs** (this is how **Facebook** does it).

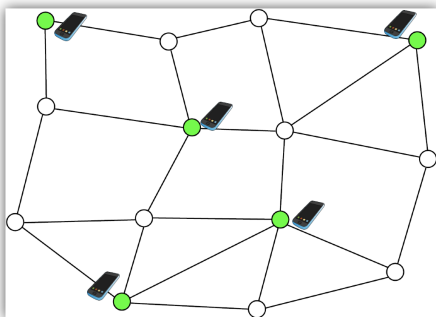
Modeling friendships:

- Represent individuals as nodes
- Represent friendships as edges
- Use graph theory



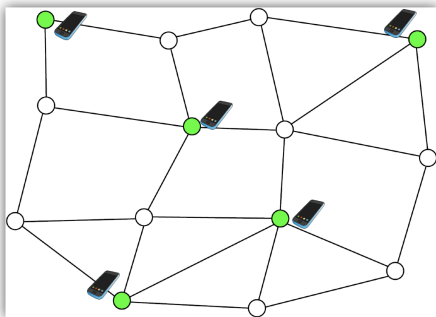
Applications of Discrete Structures

- **Question:** Question: How many free cell phones are needed to cover the graph? 3? 4? 5?



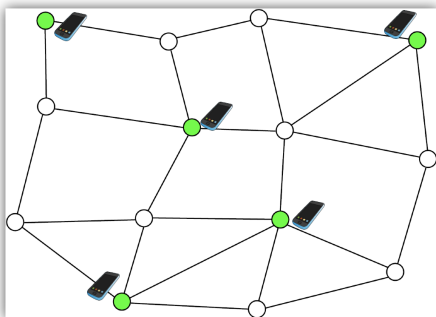
Applications of Discrete Structures

- **Question:** Question: How many free cell phones are needed to cover the graph? 3? 4? 5?
- **Five free phones** should be sufficient? (computation).



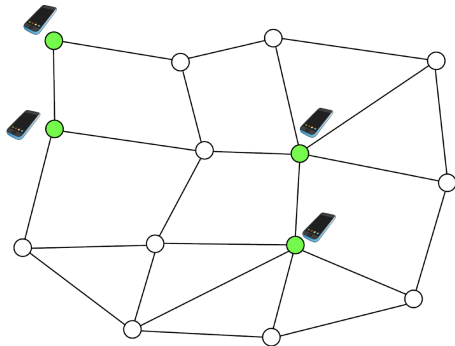
Applications of Discrete Structures

- **Question:** Question: How many free cell phones are needed to cover the graph? 3? 4? 5?
- **Five free phones** should be sufficient? (computation).
- Can we do **better**?



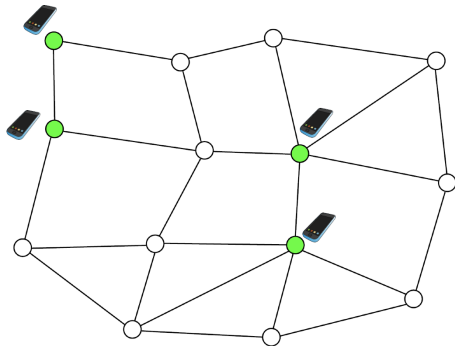
Applications of Discrete Structures

- **Question:** Question: Can we do any better than five phones?



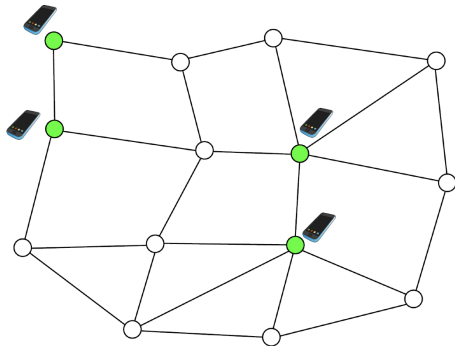
Applications of Discrete Structures

- **Question:** Question: Can we do any better than five phones?
- **Yes!** Four phones are sufficient (**sets**).



Applications of Discrete Structures

- **Question:** Question: Can we do any better than five phones?
- **Yes!** Four phones are sufficient (**sets**).
- **Question:** Can you prove that is the best we can do? (**proof**)



Applications of Discrete Structures



Keep Big Picture in View

Question:
What? and Why?

Connect:
Information.

Interact:
Be part of Dialog.



Some Tips



The course is **mile wide** and **foot deep**. There will be a lot of new concepts/topic almost every week. So, **Do not fall behind**.



Participate, **do not be shy to ask questions**, So, **Be active and interactive**.



Often students say "I understood everything in class, but am unable to solve problems". The secret is **Practice, practice, and more practice**.

