

# What's wrong with this proof?



If you figure it out, don't call it out loud –  
let others ponder it as well.

Let $a$ and $b$ be non-zero such that	$a = b$
Multiply both sides by $a$	$a^2 = ab$
Subtract $b^2$	$a^2 - b^2 = ab - b^2$
Factor both sides	$(a-b)(a+b) = b(a-b)$
Divide by $(a-b)$	$a+b = b$
Since $a = b$ , we replace $b$ with $a$	$b+b = b$
Combine terms	$2b = b$
As $b$ is non-zero, divide it out	$2 = 1$

Q.E.D. (Latin for “which was to be proven”)



الرياضيات المتقطعة

Discrete Math

Fall 2011

Dr. Iyad Hatem

# So... What is it?

## ماهي الرياضيات المتقطعة

- Discrete mathematics ... is the study of mathematical structures that are fundamentally discrete, in the sense of not supporting or requiring the notion of continuity (wikipedia)
- هي دراسة البنى الرياضية التي أساسها متقطعة بحيث لا يؤخذ بعين الاعتبار مقولة الاستمرارية (ويكيبيديا).
- اي بكلمات اخرى التعامل مع اشياء ذات قيم صحيحة (المجموعات، والمنطق، والبراهين، ...الخ) وليس الاشياء ذات القيم المستمرة (كالتوابع).

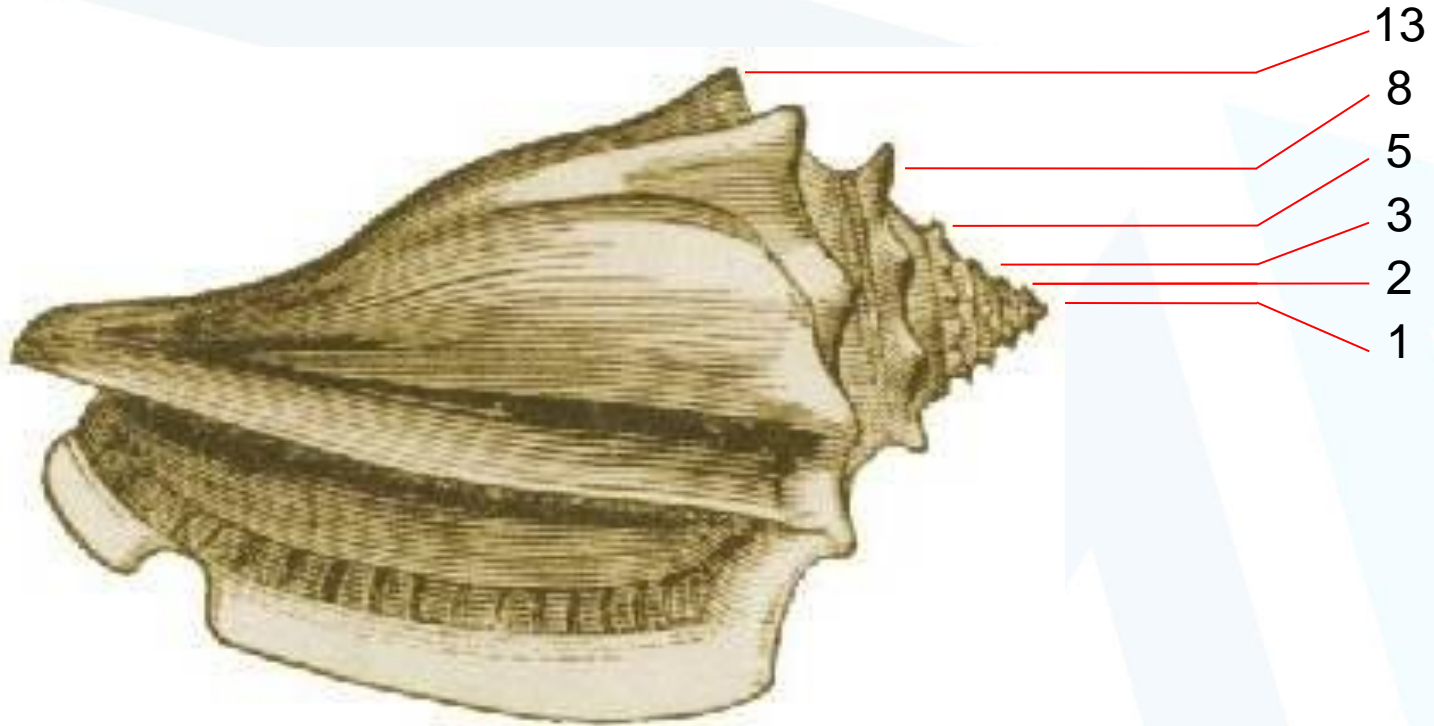


# لماذا الرياضيات المتقطعة؟

• تشكل اساس لعلم الكمبيوتر:

- Sequences
  - Digital logic (how computers compute)
  - Algorithms
  - Assuring computer correctness
  - Probability
  - Etc.
- Like how “regular” math forms the basis for science

# Sequences in Nature



# Proofs

- How do you know something is correct?
- How do you know when something is not correct?
  - Such as showing that  $2=1$ ?
- How do you think logically?
- How do you think to solve problems?

# What's wrong with this proof?



If you figure it out, do let others ponder it as well.

Suppose that  $a = b$ .  
Then  $a^2 = b^2$ .  
Subtract  $b^2$  from both sides:  $a^2 - b^2 = b^2 - b^2$ .  
Factor the left side:  $(a+b)(a-b) = b^2 - b^2$ .  
Since  $a = b$ , we can replace  $b$  with  $a$ :  $(a+a)(a-a) = b(b-b)$ .  
Simplify:  $2a(a-a) = b(b-b)$ .  
Since  $a = b$ , we can replace  $b$  with  $a$ :  $2a(a-a) = a(a-a)$ .  
Simplify:  $2a(a-a) = a(a-a)$ .  
Divide both sides by  $a(a-a)$  (which is not zero, divide by zero):  $2 = 1$ .

What's wrong with this proof? (which you can see demonstrated here)

# Course objectives

جامعة  
المنارة  
MANARA UNIVERSITY  
أهداف المقرر

- Logic: Introduce a formal system (propositional and predicate logic) which mathematical reasoning is based on
- Proofs: Develop an understanding of how to read and construct valid mathematical arguments (proofs) and understand mathematical statements (theorems), including inductive proofs. Also, introduce and work with various problem solving strategies and techniques
- Counting: Introduce the basics of integer theory, combinatorics, and counting principles, including a brief introduction to discrete probability
- Structures: Introduce and work with important discrete data structures such as sets, relations, sequences, and discrete functions
- Applications: Gain an understanding of some application areas of the material covered in the course



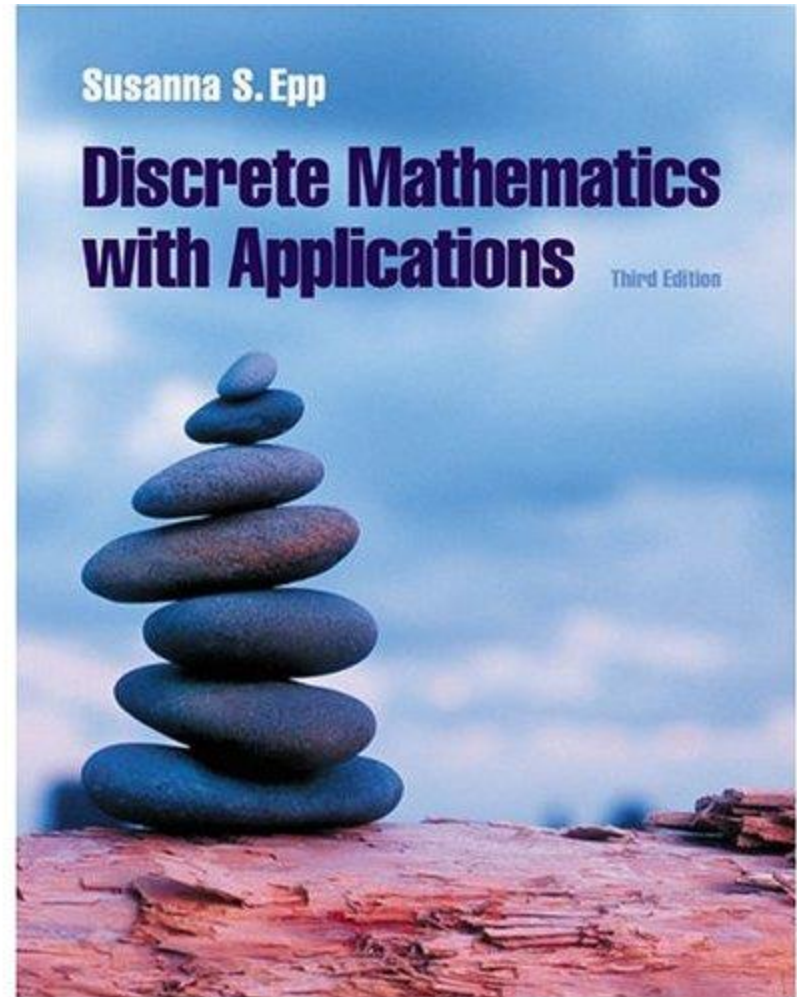


# Going over the syllabus...



# Textbook

- Susanna Epp
- Discrete Mathematics with Applications, 3rd edition
  - ISBN 0534359450



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# Where did the money go?

Three people check into a hotel. They pay \$30 to the manager and go to their room. The manager suddenly remembers that the room rate is \$25 and gives \$5 to the bellboy to return to the people. On the way to the room the bellboy reasons that \$5 would be difficult to share among three people so he pockets \$2 and gives \$1 to each person. Now each person paid \$10 and got back \$1. So they paid \$9 each, totaling \$27. The bellboy has \$2, totaling \$29. Where is the missing \$1?