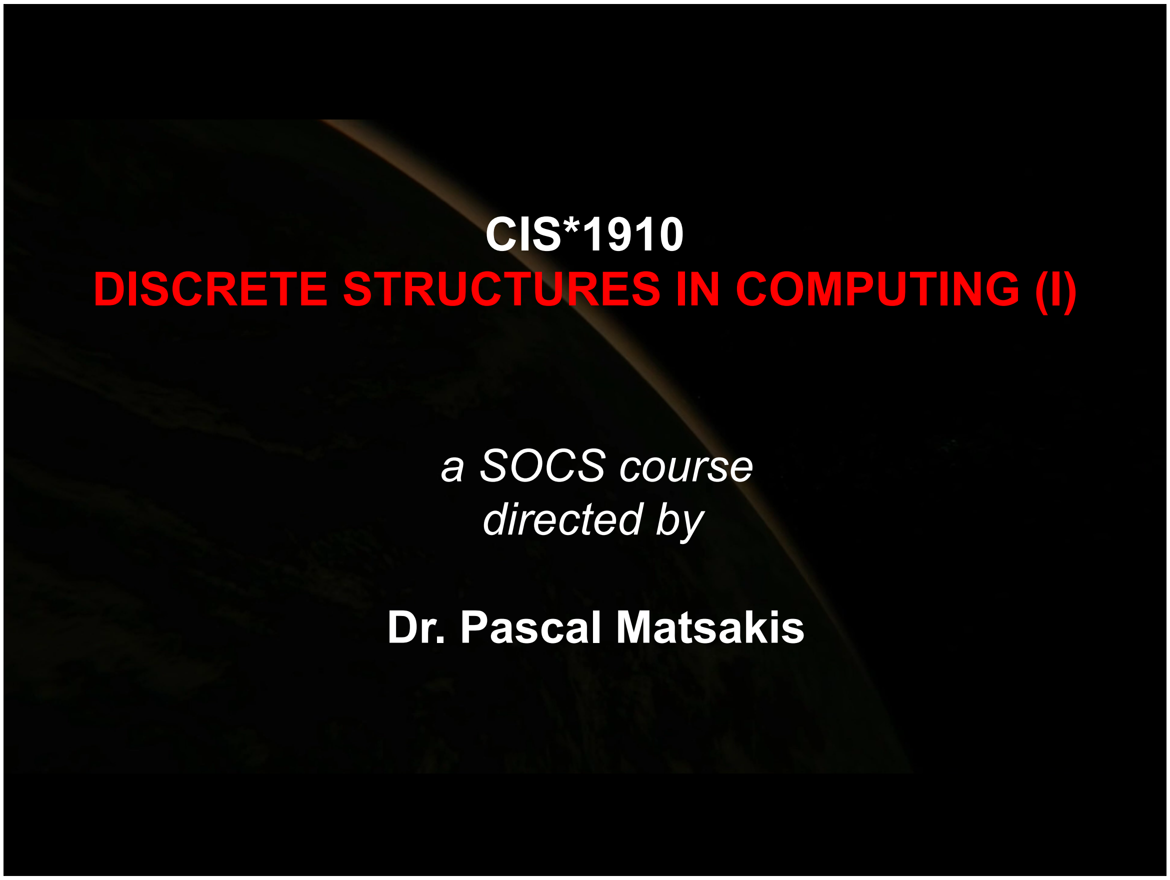

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- Typically helps improve your grades
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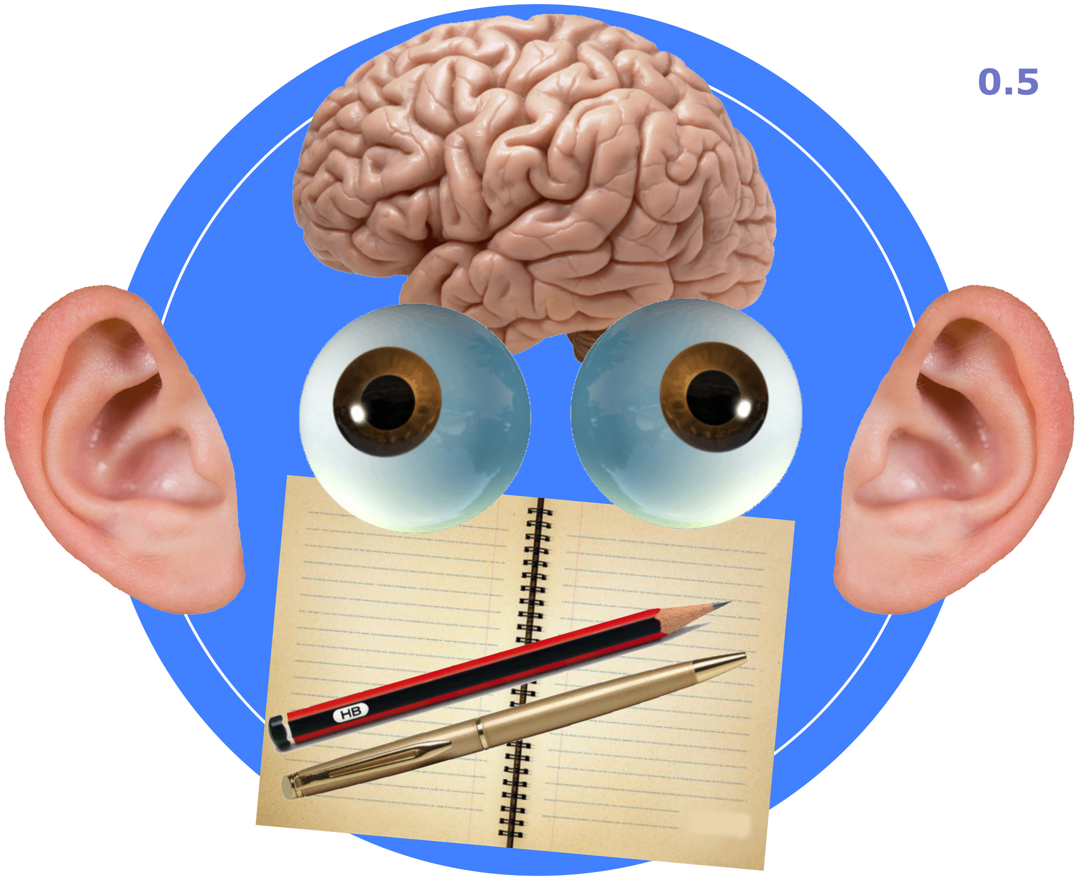


THE FIELD 0.6

Computer Science

In order to find the cluster centers V that fit the data samples X optimally, we minimize the following energy function for a closed curve:

$$J_{FCT}(U,V;X) = \sum_{i=1}^{n}\sum_{k=1}^{c}\mu_{ik}^{m}\left|\mathbf{x}_i - \mathbf{v}_k\right|^2 + \sum_{k=1}^{c}\alpha_k\left|\mathbf{v}_{k+1} - 2\mathbf{v}_k + \mathbf{v}_{k-1}\right|^2 + \sum_{k=1}^{c}\beta_k\left|\mathbf{v}_{k+1} - \mathbf{v}_k\right|^2 \qquad (3)$$

where α_k and β_k are weighting coefficients and m is usually set to 2. The cluster index should be taken circularly for a closed curve, that is, we should replace $k-j$ with $k-j+c$ if $k-j<0$, and replace $k+j$ with $k+j-c$ if $k+j>c$, where $j=1$ or 2. We minimize the following function for an open curve:

$$J_{FCT}(U,V;X) = \sum_{i=1}^{n}\sum_{k=1}^{c}\mu_{ik}^{m}\left|\mathbf{x}_i - \mathbf{v}_k\right|^2 + \sum_{k=2}^{c-1}\alpha_k\left|\mathbf{v}_{k+1} - 2\mathbf{v}_k + \mathbf{v}_{k-1}\right|^2 + \sum_{k=1}^{c-1}\beta_k\left|\mathbf{v}_{k+1} - \mathbf{v}_k\right|^2 \qquad (4)$$

For an open curve, the cluster index should be strictly between 1 and c.

Discrete Structures

WHEN?
Whenever objects are counted.
Whenever relationships between finite sets are studied.
Whenever processes involving a finite number of steps are analyzed.

Discrete Structures

EXAMPLES
How can I encrypt a message so that no unintended recipient can read it?
How can it be proved that a sorting algorithm correctly sorts a list?
How can a circuit that adds two integers be designed?
How many valid Internet addresses are there?

THE COURSE 0.9

Discrete Structures

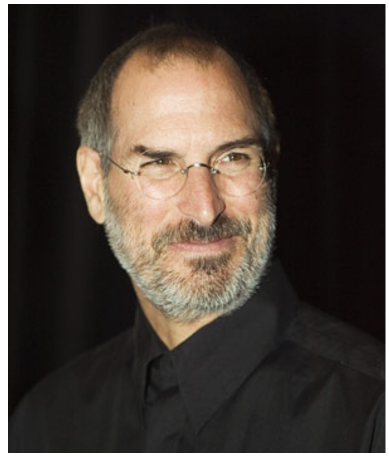
GOALS

Learn how to work with discrete structures
(i.e., learn related mathematical concepts and learn how to think logically and mathematically)

Learn mathematical foundations for many computer science courses
*(data structures CIS*2520, digital systems CIS*3120, the theory of computation CIS*3150, the analysis and design of computer algorithms CIS*3490, image processing CIS*4720, computer graphics CIS*4800, etc.)*

THE INSTRUCTOR 0.10

THE TEACHING ASSISTANTS 0.11



THE STUDENTS 0.12

THE STUDENTS 0.13

THE KEYS TO SUCCESS 0.14

☐ I will have fun (in a responsible way)
☐ I will work hard (on a regular basis)

☐ I will attend all the lectures and take notes
☐ I will study the lecture notes and my notes after each lecture
☐ I will complete all the reading assignments

☐ I will attend all the labs and take notes
☐ I will study the lab notes and my notes after each lab
☐ I will ask for help when needed

☐ I will start working on the assignments as soon as possible
☐ I will submit all the assignments

WHAT TO DO NEXT 0.15

- ☐ Read the course outline accessible through CourseLink
- ☐ Get an i>clicker and register it
- ☐ Get the zyBook

THE ZYBOOK 0.16

1.1 Sets and subsets

Sets play an important role in almost every area of mathematics, including discrete mat
mathematics in its own right, most of which is beyond the scope of this material. We wi
ideas related to sets, all of which will be used extensively in the rest of the topics covere

A ***set*** is a collection of objects. Objects may be of various types, such as titles of books,
material is mostly concerned with sets of mathematical objects like numbers. The objec
elements of different varieties, e.g., a set whose elements are the number 2, a strawberr

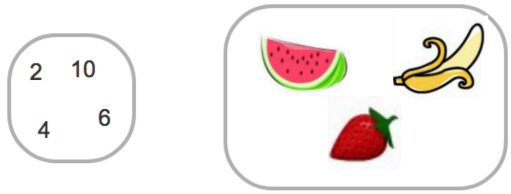
A set is defined by indicating which elements belong to it. If the number of elements in a
by listing its elements. The ***roster notation*** definition of a set is a list of the elements enc
separated by commas. The following definition of the set A uses roster notation:

$$A = \{ 2, 4, 6, 10 \}$$

THE ZYBOOK 0.17

PARTICIPATION ACTIVITY 1.1.1: Example of sets.

The set N The set F



N = { 2, 4, 6, 10 }

This set has four real-number elements

F = { Watermelon, Strawberry, Banana }

This set has three fruit elements

THE ZYBOOK 0.18

A brief note from your instructor:

Strings are covered in the zyBook, but not in lecture classes.

Strings

If A is a set of symbols or characters, the elements in A^n can be written without the usı ordered n-tuples. For example, if A = {x, y}, the set A^2 would be { xx, xy, yx, yy }. A sequeı characters used in a set of strings is called the ***alphabet*** for the set of strings. The ***leng*** string. For example, the length of the string xxyxyx is 6.

A ***binary string*** is a string whose alphabet is {0, 1}. A ***bit*** is a character in a binary strinc The set of binary strings of length n is denoted as $\{0,1\}^n$. An example of a binary string strings are fundamental objects in computer science: the input and output of every coı

THE ZYBOOK 0.19

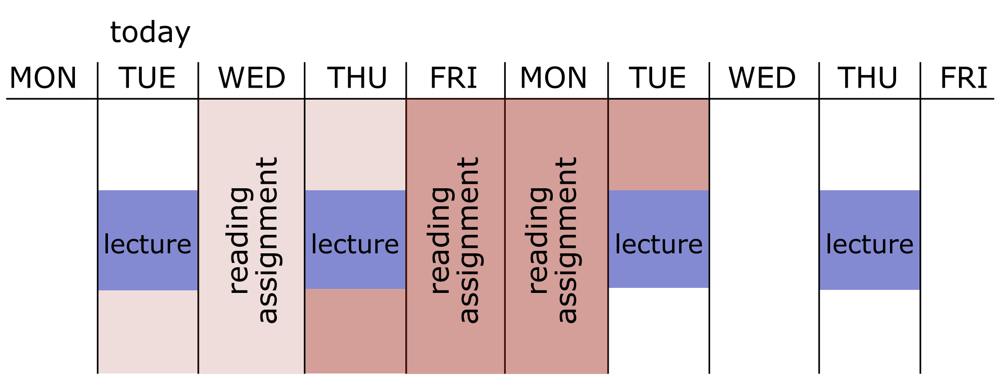
A brief note from your instructor:

*** IGNORE *** everything below.

A sequence is ***increasing*** if for every two consecutive indices, k and k + 1, in the doma
two consecutive indices, k and k + 1, in the domain, $a_k \leq a_{k+1}$. Notice that an increasin
because if $a_k < a_{k+1}$ then it is also true that $a_k \leq a_{k+1}$.

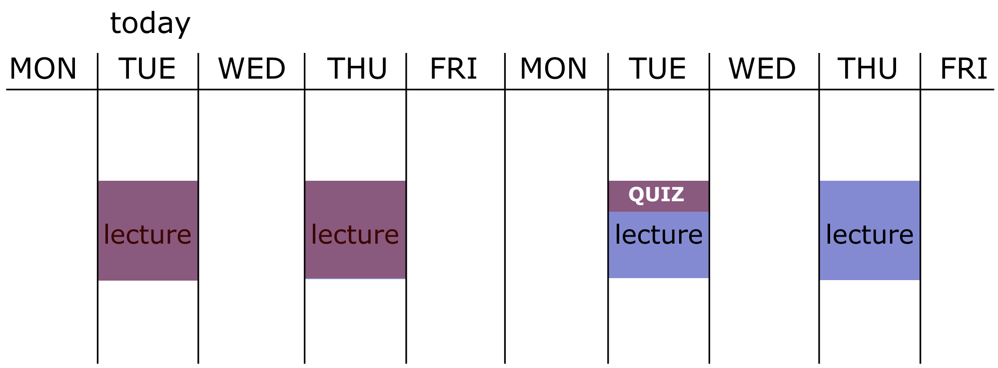
A sequence is ***decreasing*** if for every two consecutive indices, k and k + 1, in the doma
two consecutive indices, k and k + 1, in the domain, $a_k \geq a_{k+1}$.

COMING DEADLINES 0.20



Reading assignment: Up to Section 1.1 of the zyBook

COMING DEADLINES 0.21



COMING DEADLINES 0.22

- ☐ First reading assignment by Thursday (zyBook needed)
- ☐ First quiz next Tuesday (i>clicker needed)
- ☐ First assignment by Thu Jan 24
- ☐ Midterm examination on Sat Mar 2