Computer Programming

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Session: Sorting: Some Motivation

Quick Recap of Relevant Topics

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- Basic constructs used to write useful programs
  - Assignment statements
  - Arithmetic and logical expressions
  - Basic input and output
  - Sequential and conditional statements
  - Iteration constructs
  - Functions
  - Arrays and matrices

Overview of This Lecture

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- The sorting problem
  - Some motivation
  - Applicability in different contexts

Quiz1, Quiz2 and Quiz3 Marks in CS101

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ROLL NUMBER	Q1	Q2	Q3	Total
14010101	9	8	7	24
14020202	9	6	3	18
14030201	6	5	6	17
14020103	9	8	8	25
14001122	10	8	9	27
14020202	7	8	9	24

- Rank all students in decreasing order of "Total" marks
- Find the "n" top scoring students in Quiz 1
- Find the "n" least scoring students in Quiz 3

Quiz1, Quiz2 and Quiz3 Marks in CS101

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ROLL NUMBER	Q1	Q2	Q3	Total
14010101	9	8	7	24 (3)
14020202	9	6	3	18 (4)
14030201	6	5	6	17 (5)
14020103	9	8	8	25 (2)
14001122	10	8	9	27 (1)
14020202	7	8	9	24 (3)

- Rank all students in decreasing order of "Total" marks
- Find the "n" top scoring students in Quiz 1
- Find the "n" least scoring students in Quiz 3

Quiz1, Quiz2 and Quiz3 Marks in CS101

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ROLL NUMBER	Q1	Q2	Q3	Total	
14001122	10	8	9	27	1
14020103	9	8	8	25	2
14010101	9	8	7	24	3
14020202	7	8	9	24	3
14020202	9	6	3	18	4
14030201	6	5	6	17	5

- Rank all students in decreasing order of "Total" marks
- Find the "n" top scoring students in Qu
- Find
students in Quiz 3

Which entry appears topmost among equals? Rank by Roll Numbers?

Quiz1, Quiz2 and Quiz3 Marks in CS101

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ROLL NUMBER	Q1	Q2	Q3	Total
14001122 (1)	10	8	9	27
14020103 (2)	9	8	8	25
14010101 (2)	9	8	7	24
14020202 (2)	9	6	3	18
14020202 (3)	7	8	9	24
14030201 (4)	6	5	6	17

- Rank all students in decreasing order of "Total" marks

- Find the "n" top scoring students in Quiz 1

- st

Which entry appears topmost among equals?
Rank by "Total" marks?

Quiz1, Quiz2 and Quiz3 Marks in CS101

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ROLL NUMBER	Q1	Q2	Q3	Total
14020202	9	6	3	18
14030201	6	5	6	17
14010101	9	8	7	24
14020103	9	8	8	25
14020202	7	8	9	24
14001122	10	8	9	27

1
2
3
4
5
5

- Rank all students in decreasing or
- Fi nts in Q

Which entry appears topmost among equals?
Rank by "Total" marks?

- Find the "n" least scoring students in Quiz 3

Some Observations

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- Same data may need to be ordered by different criteria
- Given
  - A coll… s {
  - An or…
    - For … ems … and D_j, either $D_i \sqsubseteq D_j$ is
    - true …
  - Order the data items such th…
  with respect to $\sqsubseteq$

Each row of the table of marks

SORTING

$\leq$ on Quiz 3 marks, and
if = on Quiz 3 marks, then
$\leq$ on Total marks

$\geq$ on Total marks, and
if = on Total marks, then
$\leq$ on Roll Number

Another Example: Online Ticket Purchase

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- Want to purchase an airline ticket from Mumbai to New Delhi for December 25, 2014

  List of options on any online ticketing portal **sorted** by

Allows user to look at the top few options for a given criterion, since these are likely to be most interesting

Sorting criteria could vary: What is more useful for one may be less useful for another

Yet Another Example: Phone Directory

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- Contains (name, telephoneNumber) pairs for individuals
- What if we store them in an arbitrary order?

Subodh Das	9123456780
Alex John	8923456701
Shiva Iyer	8899776655
Anjali Singh	9829019288
Anjali Verma	8819190910
… … …	

BRUTE-FORCE SEQUENTIAL SEARCH

- How do we find the telephone numbers of Shiva Iyer and Anjali Verma?

Phone Directory

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- What if names were **sorted alphabetically** (as in a dictionary) by first name and then by last name?

Alex John	8923456701
…	
Anjali Singh	9829019288
…	
Anjali Verma	8819190910
…	
Shiva Iyer	8899776655
…	
Subodh Das	9123456780
…	

Much easier to find a given name:

Searching becomes easier on sorted data

Summary

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- Sorting as a natural computational task
  - Several real-life contexts
- Sorting can help searching

Sorting and Searching:
Two Fundamental Problems in Computing