Design and Analysis of Operating Systems CSCI 3753

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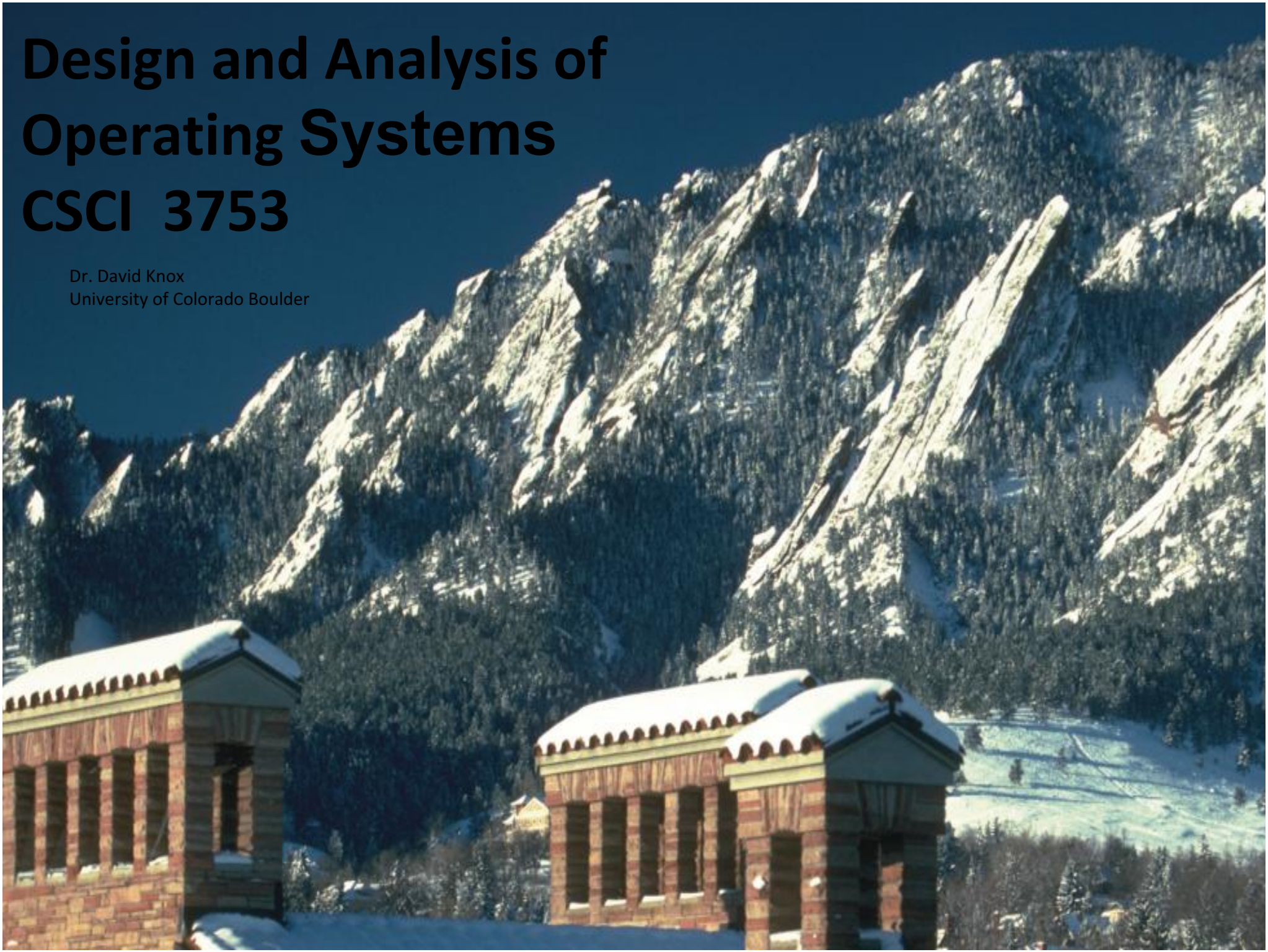

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Memory Management
Belady's Anomoly

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FIFO Page Replacement: Another example

Let page reference stream, $\mathcal{R}$ = `012301401234`

Frame	0	1	2	3	0	1	4	0	1	2	3	4
0	0	0	0	3	3	3	4	4	4	4	4	4
1		1	1	1	0	0	0	0	0	2	2	2
2			2	2	2	1	1	1	1	1	3	3

- FIFO with m = 3 has 9 faults
- Goal: To reduce the number of page fault
  - Increase the size of memory

FIFO Page Replacement: Another example

Let page reference stream, $\mathcal{R}$ = `012301401234`

Frame	0	1	2	3	0	1	4	0	1	2	3	4
0	0	0	0	0	0	0	4	4	4	4	3	3
1		1	1	1	1	1	1	0	0	0	0	4
2			2	2	2	2	2	2	1	1	1	1
3				3	3	3	3	3	3	2	2	2

- FIFO with m = 4 has 10 faults

Belady's anomaly: Increasing the size of memory may result in increasing the number of page faults for some programs.

Stack Algorithms

- **Stack algorithms are a class of page replacement algorithms that do not suffer from Belady's anomaly**

- **Key property:**

  Set of pages in memory for *n* frames is always a subset of the set of pages that would be in memory with *n+1* frames, irrespective of the page reference string

- **OPT and LRU are stack algorithms, while FIFO is not a stack algorithm**
  - The OPT and LRU algorithms will always keep a subset of the pages used in a larger number of frames
  - FIFO may end up with a different set of pages depending on the number of frames

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