



# Computer Architecture

Spring 2020

**Hamed Farbeh**

**farbeh@aut.ac.ir**

Department of Computer Engineering

Amirkabir University of Technology



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## Lectures adopted from

- Computer Organization and Design: The Hardware/Software Interface, 5<sup>th</sup> edition, David A. Patterson, John L. Hennessy, MK pub., 2014
  - Chapter 5: Large and Fast: Exploiting Memory Hierarchy

# Replacement Policy

- Direct mapped: no choice
- Set associative
  - Prefer non-valid entry, if there is one
  - Otherwise, choose among entries in the set
- Cache replacement policies (algorithms)

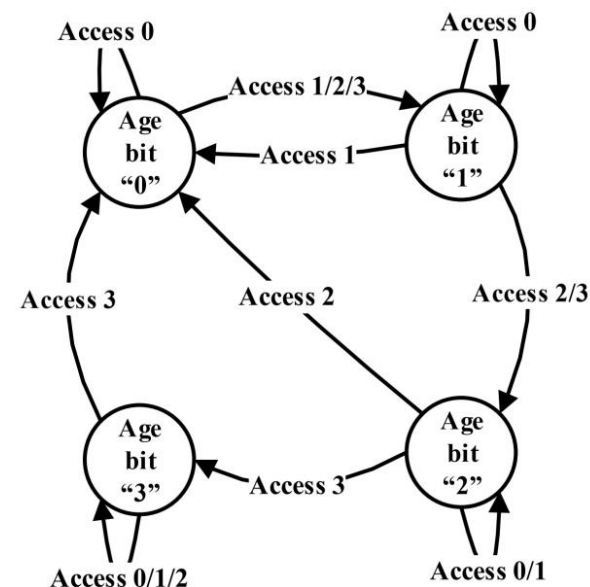
# Replacement Policy

- Cache replacement policies (algorithms)
  - Bélády's optimal algorithm (or simply optimal)
  - FIFO
  - LIFO (or FILO)
  - Most-recently used (MRU)
  - Random
  - Least-recently used (LRU)
- Bélády's anomaly
  - The phenomenon in which increasing the number of blocks results in an increase in the number of misses for certain memory access patterns

Fine more: [https://en.wikipedia.org/wiki/Cache\\_replacement\\_policies](https://en.wikipedia.org/wiki/Cache_replacement_policies)

# LRU Replacement Policy

- Age bits: show the accesses order
  - Number of bits per block:  
Log n for n-way cache



Age of Accessed Block	New Age Value of Each Block Based on Its Current Age			
	00	01	10	11
00 (Hit)	00	01	10	11
01 (Hit)	01	00	10	11
10 (Hit)	01	10	00	11
11 (Hit or Miss)	01	10	11	00