Graduate Operating Systems
(Memory Management)

Fall 2020

Working Set Model

• How much memory does a process need?
• Virtual memory & memory management
• Paging-in, paging-out
• Page replacement strategies
  – Metric: page traffic
  – Optimal
  – Random
  – FIFO
  – LRU
  – ATLAS Loop Detection
  – Belady: simple + “some” historical data
Working Set Model
Working Set Model

- Reference string: \texttt{7,0,1,2,0,3,0,4,2,3,0,3,0,3,2,1,2,0,1,7,0,1}

- Optimal
- FIFO
- LRU
Working Set Model

- Working set of information \( W(t, \tau) \)
- Working set size \( \omega(t, \tau) \)
- Properties of working set:
  - Size (Figure 3)
  - Prediction
  - Reentry rate
  - \( \tau \)-sensitivity
- \( \tau \) too small/large

Working Set Model

- In-core & use bits (Figure 5)
- if \( D > m \) \( \Rightarrow \) Thrashing
- Policy if \( D > m \), then suspend or swap out one of the processes
Working Set Model

Paper “WSCLOCK”

• Local vs. global replacement policies
• Dirty bit
• CLOCK algorithm
• Task isolation: WS vs. CLOCK
Paper “WSCLOCK”