I/O Systems

- Reading: OS Concepts: Chapters 13 & 14
- Contents
  - Methods
  - Implementation
  - Scheduling
  - Tertiary

Device I/O methods

- Interfaces to devices:
  - Ports: _____
  - Memory Mapping: _____
  - Interrupts: _____
  - DMA: _____
- Methods of communication:
  - Two-way communication: _____
  - Polling: _____
  - Interrupts: _____
  - DMA: _____

Ports

- Two way communication
  - ☞ _____
  - ☞ _____

Port Example

Polling

- Control & Status registers are memory mapped

1. Busy waiting:
   - ☞ _____
2. Issuing a Command:
   - ☞ _____
   - ☞ _____
3. Action by the Controller:
   - ☞ _____
   - ☞ _____
   - ☞ _____

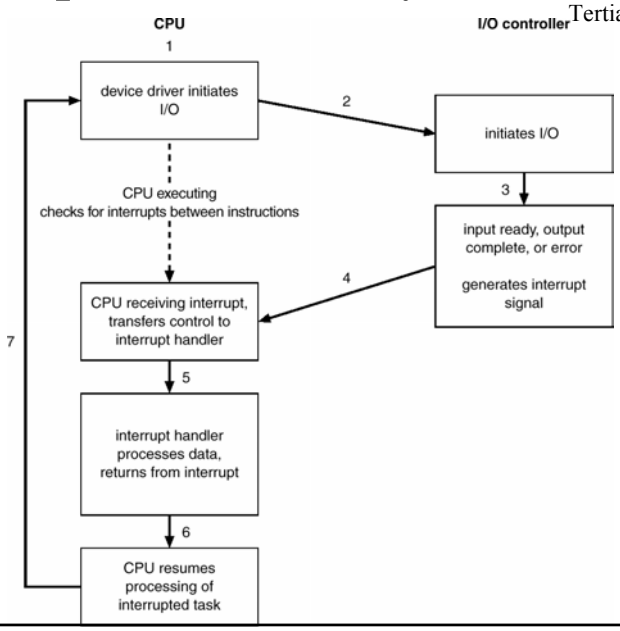
Polling Example Memory Mapping Example

Interrupts

1. CPU interrupt request line triggered by I/O device
2. Interrupt handler:
   - ☞ _____
   - ☞ _____
3. Handler:
   - ☞ _____

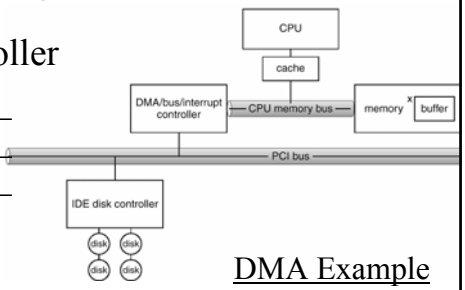
Interrupt Examples

Interrupt driven I/O cycle



DMA

- Used for movement of large amounts of data
- Requires a DMA controller
  - _____
  - _____
  - _____



- Steps

DMA Example

  - _____
  - _____
  - _____
  - _____
  - _____
  - _____

Performance

- Issues & Improvements
  - Reduce Context switches: _____
  - Reduce Data Copying: _____
  - Reduce Interrupts: _____
  - Use DMA: _____
  - Balance _____

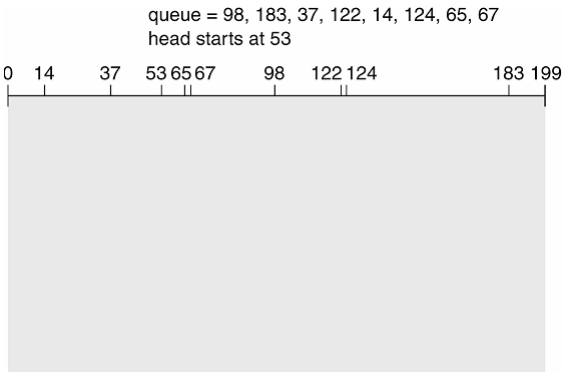
Disk Scheduling

- Access time has two major components:
  - Seek time: _____
  - Rotational latency: _____
- For Disk Drives Efficiency means
  - _____
- Algorithms
  - FCFS, SSTF, SCAN, C-SCAN, C-LOOK
- Example
  - 0-199
  - 53
  - 98, 183, 37, 122, 14, 124, 65, 67

FCFS

- Algorithm: _____
- Performance: _____
- Issues: _____

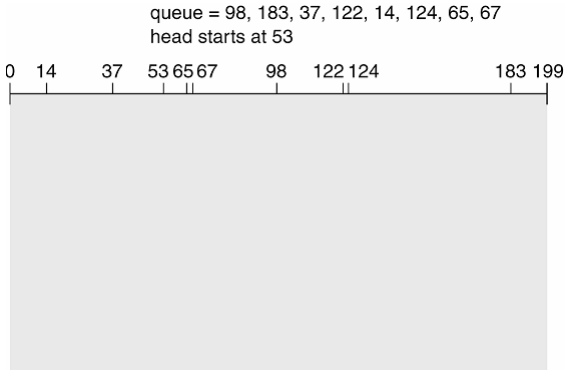
_____



SSTF

- Algorithm: _____
- Performance: _____
- Issues: _____

_____

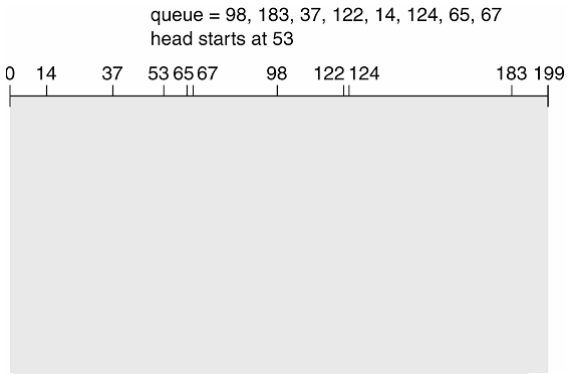


SCAN

- Algorithm: _____

_____

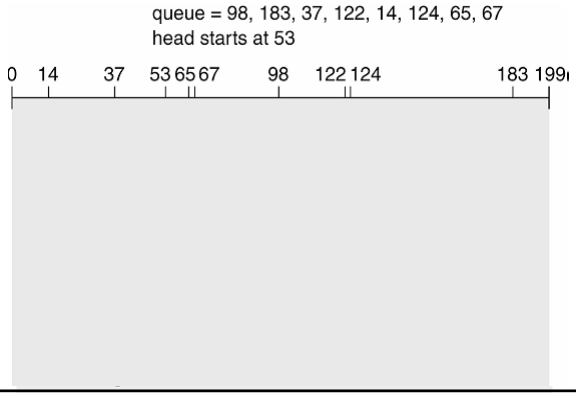
- Performance: _____
- Issues: _____



C-SCAN

- Algorithm: _____
- Performance: _____
- Issues: _____

_____

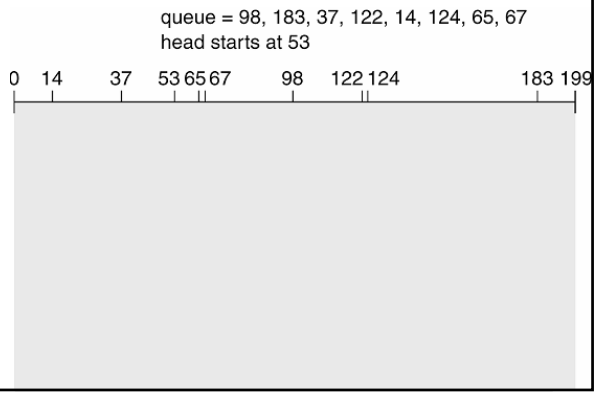


C-LOOK

- Algorithm: _____

_____

- Performance: _____
- Issues: _____



Which Algorithm?

- Considerations
  - _____
  - _____
    _____
- Common choices for default algorithm
  - _____
  - _____
    _____

Tertiary Storage

- Characteristics
  - _____
  - _____
  - _____
- Broad Classes of tertiary storage:
  - Magnetic Disks: _____
  - Optical Disks: _____
  - Tapes: _____
- Main Issues:
  - Speed: _____
  - Cost: _____
  - Reliability: _____
  - Capacity:

Magnetic Disks

- Floppy Disks (3.5”)
  - Speed: _____
  - Cost: _____
  - Capacity: _____
  - Reliability: _____
- ZIP Drives
  - Speed: _____
  - Cost: _____
  - Capacity: _____
  - Reliability: _____
- Others _____

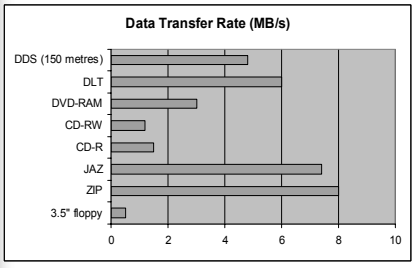
Optical Disks

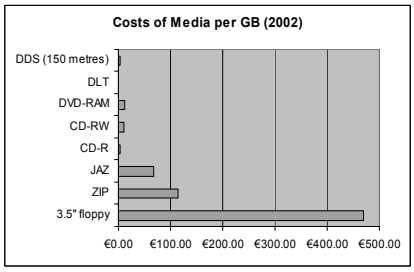
- CD-ROM, CD-R, CD-RW
  - Speed: _____
  - Cost: _____
  - Capacity: _____
  - Reliability: _____
- DVD
  - Speed: _____
  - Cost: _____
  - Capacity: _____
  - Reliability: _____

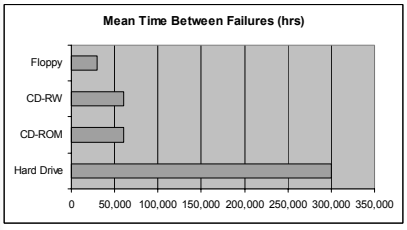
Tapes

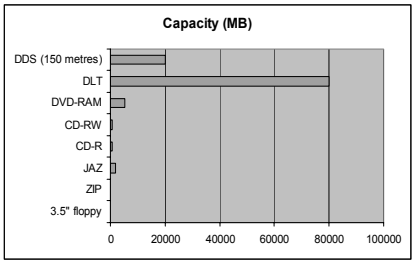
- Tapes
  - Speed: _____
  - Cost: _____
  - Capacity: _____
  - Reliability: _____
- Operations
  - Read & Write
  - Locate: _____
  - Read position: _____
  - Space: _____
  - EOT mark _____

Media Comparison









OS Issues

- For any media the OS provides two possible abstractions:
  - _____
    _____
    - _____
  - Raw device: _____
    - E.g. Tapes
      - _____
      - _____
- Naming of removable media
  - Problem: _____
  - Solution: _____