# Lecture 3: Virtual Memory and Process Management

# Outline of activities

# Virtual Memory: Segmentation and Paging

- 1. Three kind of addresses
  - Logical (16-bit segment id and 32-bit offset)
  - Linear (32-bit unsigned)
  - Physical (32-bit unsigned)
- 2. Segmentation registers
  - cs, ss, ds
  - es, fs, gs
- 3. Segment descriptors (8 bytes)
  - Base (32-bit)
  - G flag (0 = byte, 1 = 4KB)
  - Limit (20-bit)
  - S flag (0 = kernel, 1 = normal code or data segment)
  - Type (4-bit)
    - Code segment descriptor
    - Data segment descriptor
    - Task State Segment descriptor, etc.
- 4. Segment selectors (6 nonprogrammable registers)
- 5. Global Descriptor Table (GDT), Local Descriptor Table (LDT)
  - $\bullet \ gdtr$
  - $\bullet$  ldtr
- 6. Page and Page Frame
- 7. Page table
  - Single level
  - Multi level
- 8. Translation Lookaside Buffer (TLB)

# Break

# **Process Management**

- 1. Process model (see Figure 1)
- 2. Process states (see Figure 2)

- 3. Process creation
  - (a) System initialization
  - (b) User's request to create a process
  - (c) Initiation of a batch job
- 4. Process termination
  - (a) Normal exit (voluntary)
  - (b) Error exit (voluntary)
  - (c) Fatal error (involuntary)
  - (d) Killed by another process (involuntary)
- 5. Process hierarchy (see example)
- 6. Process suspension (see Figure 3)



Figure 1



Figure 3.5 Five-State Process Model







