Process Management

process
- unit of work
- program in execution
- active entity

program
- executable code
- passive entity

operating system processes execute system code
user processes execute user code

batch system – jobs
time-share system – tasks, user programs
single user system – tasks

Process Structure
- text section
  - code
- current state
  - PC
  - IR
  - PSW
  - other registers
  - open files
  - etc
- process (user) stack
  - function parameters
  - return addresses
  - local variables
- data section
  - global variables
- heap
  - dynamically allocated memory

Multiple processes may use the same code; e.g., multiple users may use the same program source on the server to edit individual programs; each user may get their own copy of a segment of the code, but it still constitutes multiple processes using the same code
State Diagram of Process Execution

- **New Process Queue**
  - Memory Allocated

- **Ready Queue**
  - P₅ ... P₈ P₃ P₇

- **I/O Wait Queue**
  - P₉ ... P₄ P₃ P₆

- **Event Wait Queue**
  - P₁ ... P₂

- **CPU Process Actively Executing**

- **Terminated Process**
  - Memory Deallocated

**Process State**
- **New** – process is being created
- **Running** – process is in a processor, i.e., program instructions are being executed
- **Waiting** – process is waiting for some event to occur
- **Ready** – process is waiting to be assigned to a processor
- **Terminated** – process has finished execution
Process Control Block (PCB)  
(aka task control block)  
PCB contains  
- Process State – new, running, etc.  
- contents of the PC  
- contents of the CPU Registers  
  - accumulators  
  - index registers  
  - PSW  
  - general-purpose registers  
  - etc  
- CPU Scheduling Information  
- Memory Management Information  
  - page &/or segment tables  
  - contents of base & limit register  
- Accounting Information  
  - CPU time used  
  - real time used  
  - process (job) numbers  
  - account numbers  
  - etc  
- I/O Status Information  
  - list of I/O devices allocated to the process  
  - list of open files  
  - etc.