Process Management

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

program
- executable code
- passive entity

operating system processes execute system code
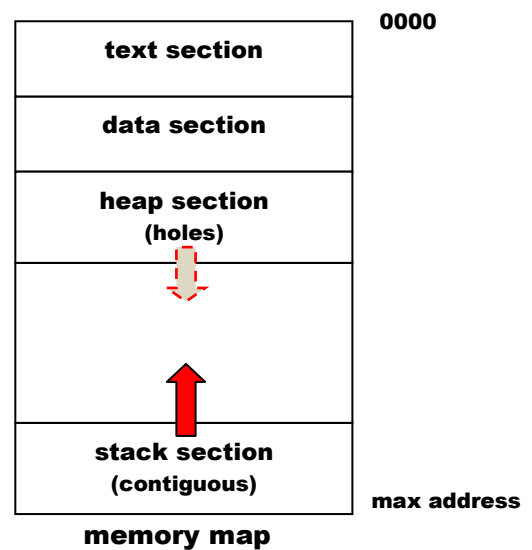**user processes execute user code**

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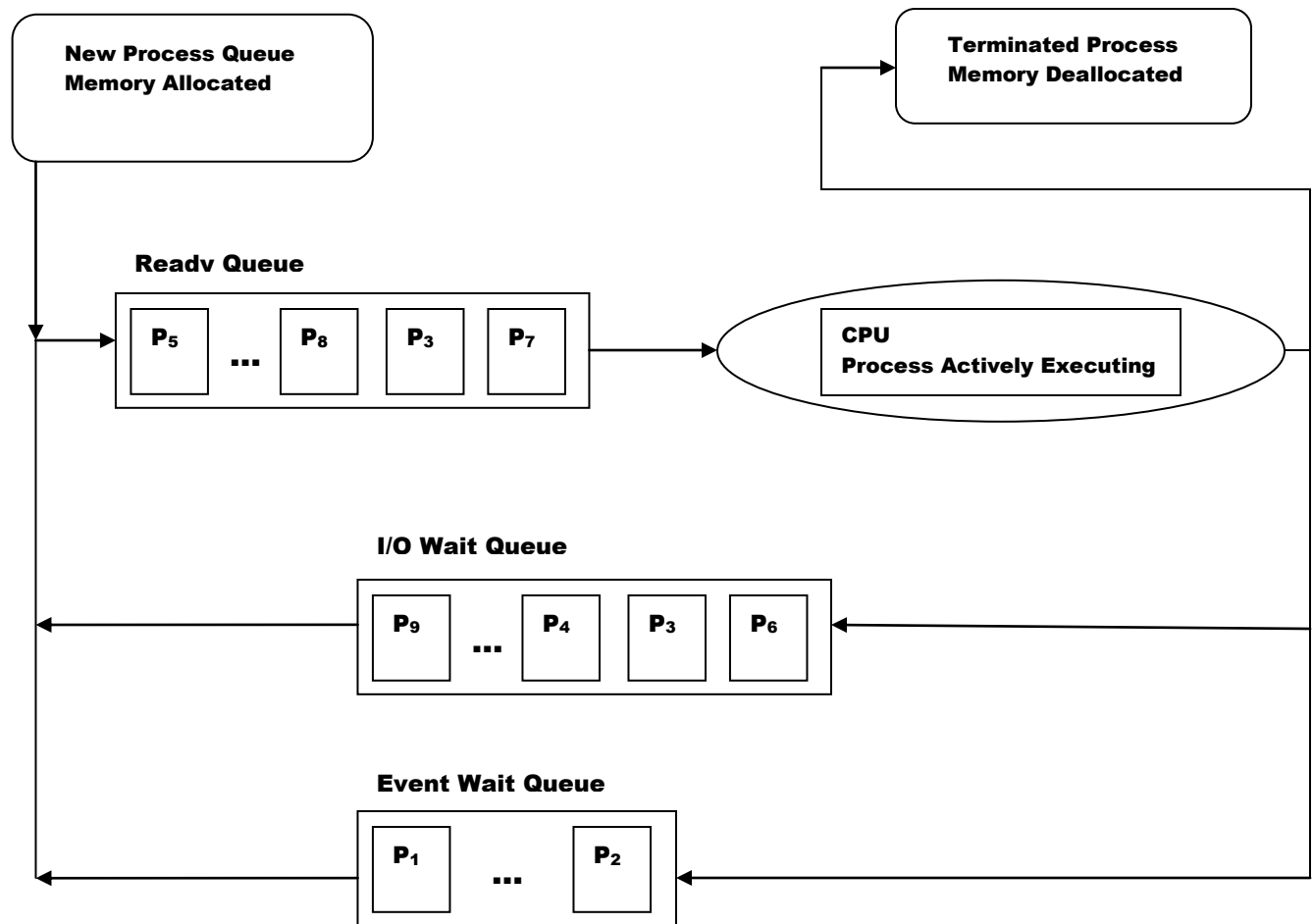**time-share system – tasks, user programs**
single user system – tasks

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**

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text section	
data section	
heap section (holes)	
stack section (contiguous)	max address

memory map

Multiple processes many 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

Terminated Process
Memory Deallocated

Ready Queue

P_5	...	P_8	P_3	P_7

CPU
Process Actively Executing

I/O Wait Queue

P_9	...	P_4	P_3	P_6

Event Wait Queue

P_1	...	P_2

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.**