### Deadlocks (5)

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# **Example of Detection Algorithm**

Five processes  $P_o$  through  $P_4$ ; three resource types A (7 instances), B (2 instances), and C (6 instances) Snapshot at time  $T_o$ :

	<u>Allocation</u>	<u>Request</u>	<u>Available</u>
	ABC	ABC	ABC
$P_{ m o}$	010	0 0 0	0 0 0
$P_{\scriptscriptstyle 1}$	200	202	
$P_2$	303	0 0 0	
$P_3$	211	100	
$P_4$	002	002	

Sequence  $\langle P_0, P_2, P_3, P_1, P_4 \rangle$  will result in **Finish[i]** = true for all **i** 

#### Example (Cont.)

 $P_2$  requests an additional instance of type C

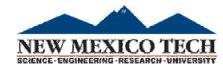
State of system?

Can reclaim resources held by process  $P_o$ , but insufficient resources to fulfill other processes; requests

Deadlock exists, consisting of processes  $P_1$ ,  $P_2$ ,  $P_3$ , and  $P_4$ 

## **Recovery from Deadlock: Process Termination**

- ☐ Abort all deadlocked processes
- ☐ Abort one process at a time until the deadlock cycle is eliminated
- ☐ In which order should we choose to abort?
  - ☐ Priority of the process
  - ☐ How long process has computed, and how much longer to completion
  - ☐ Resources the process has used
  - ☐ Resources process needs to complete
  - ☐ How many processes will need to be terminated
  - ☐ Is process interactive or batch?



#### Recovery from Deadlock: Resource Preemption

- ☐ Selecting a victim minimize cost
- □ Rollback return to some safe state, restart process for that state
- □ Starvation same process may always be picked as victim, include number of rollback in cost factor

