3a. (10 points) Priority inversion

Three real-time tasks bus manager (t1: frequent: high priority), communication task (t2: medium priority) and meteorological task (t3: low priority) run on the NASA Mars Pathfinder. NASA has sent out an urgent request to solve a problem that PathFinder is frequently resetting spontaneously losing all the data. Can you diagnose the problem and solve the problem for NASA?

Assume that the tasks with their resource requirements as given below: {arrival time, execution time, priority, resource need}:

(a) t1: { 4, 4, 1:[B:2]} where the task executes for 1 time unit, then requests resource B for 2 time unit, *and then completes the task*

(b) t2: { 6, 5, 2:[none]} where the task executes for 4 times units and has no resource request.

(c) t3: { 0, 7, 3:[C:4[B:3]]} where the task executes for 2 units, then requests resource C, and after 1 time unit requests resource B for 3 times units. (totally 4 time units of resource C)

Construct the schedule for the system using only simple priority policy and illustrate the occurrence of priority inversion. {arrival time, total run time, priority (1 highest), resources}
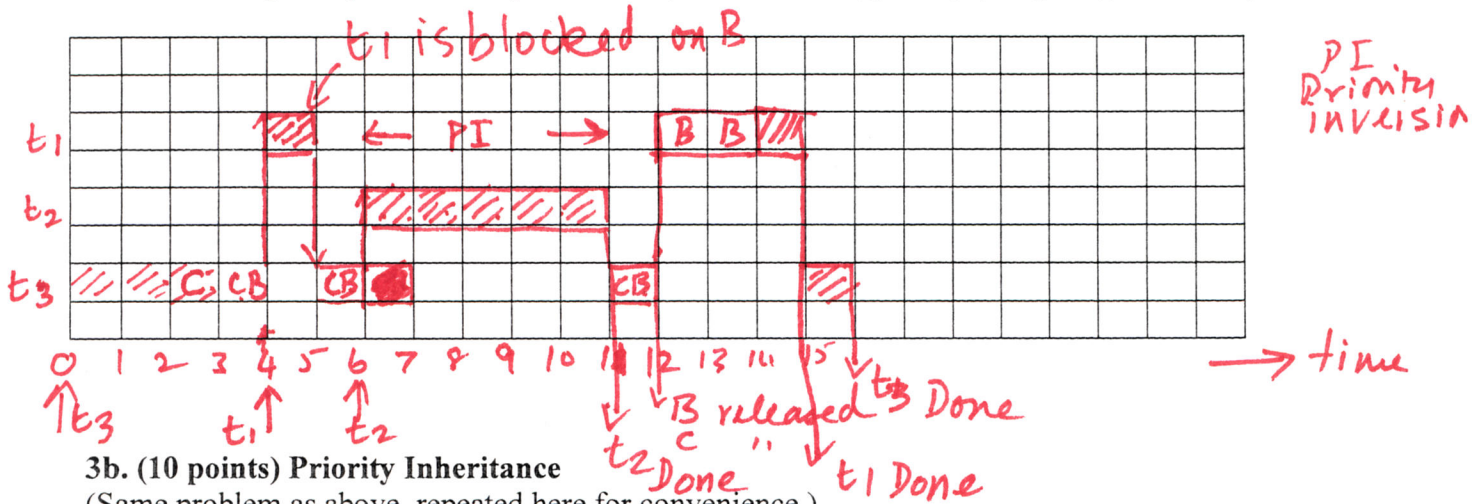
3b. (10 points) Priority Inheritance
(Same problem as above, repeated here for convenience.)
Construct the schedule for the system using priority inheritance and illustrate how it solves the priority inversion problem.

Priority inheritance is ~~between~~ : when a higher priority task is block due to a shared resource between a low priority task, Low priority TEMPORARILY inherits higher priority

1. (20 points) Cyclic Executive and cyclic schedule For the small scale task set given below design a cyclic schedule: (i) determine the hyper-period (ii) determine frame size, (iii) provide a timing chart and (iv) a cyclic (executive) schedule. Show all the formal expressions (rules) used in the computation.

ti	ri	ei	pi	Di
t1	0	2	4	4
t2	0	1	6	6
t3	0	1	12	12