Directions: Choose only two out of the three problems listed below. If you attempt all three, only questions one and two will be graded. Please show all work.

    a.  (8pts) List the four standard necessary conditions of Deadlock.

    b.  (8pts) Let P be a set of proce sh1 144.05 585.9 7d twBT1 0 0 1 31.75 616.1.7m(be)5( )-RIftend et s

a. Below is a set of processes with CPU burst times listed in milliseconds.

| Process | Arrival Time | CPU burst |
|---------|--------------|-----------|
| 1 | 0 | 10ms |
| 2 | 5 | 5ms |
| 3 | 2 | 2ms |
| 4 | 6 | 8ms |
| 5 | 1 | 12ms |

a. (8 pts) Draw a Gantt chart for the *Shortest Remaining Time First* scheduling algorithm. Label the ending times of each process.

b. (8 pts) Draw a Gantt chart for the *Round Robin* scheduling algorithm. Assume round robin ordering starts with Process 1. Use a time quantum of *4ms*. Label the ending times of each process.

c. (4 pts) For Round Robin in part b) above, what is the *average wait time*? What is the *turnaround time*?

1) Given a

**Choose only two out of the three problems listed below. If you attempt all three, only questions one and two will be graded. Please show all work.**

**1).** Consider   = {a, b}:

    **a.**              State the Pumping Lemma for regular languages.

    **b.**                              the following language    a regular language:

$$L = \{ a \; b \; : \qquad \}$$

**2).** Consider   = {a, b}:

    **a.**            Give one example of a context free language.

    **b.**              one example of a language that is not context free.

    **c.**              the class of context free languages closed under intersection? Prove your answer.

**3).**              Problem takes as input a set S of integers. The question is whether S can be divided into two subsets A and    such that      $x =$      $y$ ?

    **a.**            How do you prove, in general, that a Problem X is NP complete? Please give the steps.

    **b.**              Prove that                   Problem        complete. You may    assume    that    CNF SAT,    3 CNF SAT,    VERTEX COVER, CIRCUIT, and SUBSET SUM are all known to be NP complete.