Question 1

1. For each of the following statements specify if it is (1) a safety property; (2) a liveness property; (3) a combination of safety and liveness; or (4) not a property at all.
   
   (a) The car speed is at most 100 mph.
   (b) The network link delay is at least 5 microseconds.
   (c) The delayed flight will eventually depart.
   (d) If a user enters a wrong password to the login process, he/she will be allowed to retry, but no earlier than in 40 seconds.
   (e) The user logout process completes in at most 20 seconds.
   (f) The expected number of new Yahoo! accounts is 1500 daily.
   (g) The administrator will be notified on any malfunction in the system.
   (h) Every driver gets a parking ticket at least twice.
   (i) No process crashes from some point of the execution onward.
   (j) Once a request is made, it remains registered unless answered.

2. Consider a process scheduler in some imaginary operating system. For each of the following statements specify if it is (1) a safety property; (2) a liveness property; (3) a combination of safety and liveness; or (4) not a property at all.

   (a) A process is created in theREADYstate.
   (b) A process in aREADYstate eventually becomesRUNNING.
   (c) A process can becomeRUNNINGonly from aREADYstate.
   (d) No process is in theRUNNINGstate infinitely long without being preempted.
   (e) A process remains in theRUNNINGstate at most 1 minute.
Question 2

Prove Lemma 1’ (slide 29 in lecture 1)

Question 3

In this question we consider the synchronous message passing communication model, where messages can be lost and add the following assumption to the model:

- Eventual delivery: an unknown finite number of messages are lost on each channel.

1. Give an algorithm for the Coordinated Attack Problem that satisfies the Agreement, Validity and Termination requirements, or prove that no such algorithm exists.

2. We add the following requirement:

   - Halt: both generals eventually halt (i.e., reach a halting state).

A halting state is defined as a state of a process (e.g. a general), from which no further activity can occur. That is, no messages are generated and the only state transition is a self-loop.

Give an algorithm for the Coordinated Attack Problem that satisfies the Agreement, Validity, Termination and Halt requirements, or prove that no such algorithm exists.