1. (14 points) Identify all of the following statements that are true with respect to agents and multiagent systems

   A. Using rules we can carry out reasoning that is impossible using OWL

   \[ \text{Solution: A is true:} \]

   B. Because rules can be arbitrarily complex, we cannot use them as components of justifications in a TMS

   \[ \text{Solution: B is false:} \]

   C. The Distributed TMS discussed in class ensures global consistency of the participating agents

   \[ \text{Solution: C is false: it cannot ensure global consistency and simply ensures local-and-shared consistency} \]

   D. The Distributed TMS can undo a logical conclusion whose premises are falsified but it cannot naturally undo the effect of an action that may no longer be needed

   \[ \text{Solution: D is true: the effects of actions are in the real-world and may be permanent (as in our example, where shares of a company are bought at a certain price) so in general the actions are difficult to undo; in the business transaction sense, we can define compensates for some actions, but such transactions are outside the realm of the Distributed TMS, which merely maintains justifications for logical conclusions and has no way of executing compensates} \]

   E. In simple terms, the main difference between an agent and an object is that an object can say “No!” but an agent must do as it committed

   \[ \text{Solution: E is false: an agent (in light of its autonomy) can always violate its commitments, even though in some settings it may be penalized as a result of doing so} \]

   F. Agents must be aware of their interactions: thus if an agent silently consumes a resource that another agent could have used, then no interaction takes place between them

   \[ \text{Solution: F is false: interactions can include resource contentions; a resource that Alice may have exploited may previously be consumed by Bob, and Alice wouldn’t know the resource was missing} \]

   G. Two agents can be said to be communicating only if when one agent sends the other agent a message, the other replies

   \[ \text{Solution: G is false:} \]

2. (16 points) Identify all of the following statements that are true about the Hohfeldian concepts, commitments, and commitment protocols

   A. In our virtual enterprise example, once the seller VE confirms the price of some goods to the buyer, the seller cannot change the price for the current transaction; this means the buyer has the power to dictate the price

   \[ \text{Solution: A is false: the buyer has immunity from price changes by the seller, but the buyer has no power to dictate the price for the transaction} \]
B. The release of a commitment means it is dissolved

**Solution:** B is true:

C. An agent may do what its commitment requires even after the commitment has been released

**Solution:** C is true:

D. In an open environment, we can typically ensure compliance based upon the implementations of the interacting agents

**Solution:** D is false: the implementations of agents are, in general, not available in an open environment

E. The benefit of employing a commitment protocol is that it exactly specifies the order of the messages without regard to their meaning

**Solution:** E is false: commitment protocols are all about meaning and not about specifying message order

F. Using the meanings of the messages, we can compute whether a message may be sent in the current state, and the next state that would result from doing so

**Solution:** F is true:

G. Ideally, each participant in a protocol should be able to verify if any of the commitments where it is the creditor are violated

**Solution:** G is true:

H. If we could somehow take “simultaneous” snapshots of agents A and B immediately after A receives a message from B, we would find that A’s vector clock is ahead of B’s vector clock

**Solution:** H is false: A’s vector clock will be ahead of where B’s vector clock was when B sent the specified message; however, in the time that the message was in transit, B may have sent or received other messages