1. (8 points) Problems on dependencies and events (here \( \land \) and \( \lor \) are delimiters)
   
   A. The guard produced by \( \Gamma \land \neg \exists \cdot e \land \neg \) on \( f \) is \( \Diamond e \)
   
   Solution: A is true:
   
   B. Given exactly two dependencies that produce guards on event \( f \) of \( \Diamond e \) and \( \Diamond e \), respectively, we know that \( f \) may happen anytime
   
   Solution: B is false: \( f \) may not happen because the guards \( \Diamond e \) and \( \Diamond e \) cannot both be satisfied
   
   C. If a service exposes a (significant) event, that means we can delay such an event in order to ensure that any stated dependencies are satisfied
   
   Solution: C is false: we can delay only flexible or inevitable events, not immediate events
   
   D. If a service’s event is marked as inevitable, the event must occur whether the service likes it or not
   
   Solution: D is false: an inevitable event must occur only if the service requests it

2. (30 points) Problems on collaboration
   
   A. A technical requirement resulting from exception handling is that the information provided by a business service may be tentative and subject to revisions
   
   Solution: A is true: as in our VE example, an exception (such as in manufacturing) can cause a business service to revise the information it provided others
   
   B. A technical requirement resulting from supporting services that can make revisions to their results is that the consumers of such services be sufficiently long-lived
   
   Solution: B is true: the consumers of such services must live long enough to receive the revisions
   
   C. In ontology terms, a service can fulfill a need if its input and output classes respectively subsume the input and output classes of the needed service
   
   Solution: C is false: the fulfilling service should subsume the input classes of the needed service and the needed service should subsume the output classes of the fulfilling service
   
   D. Given OWL-S models for services, a valid service composition would try to invoke a service only in a state where its preconditions would be satisfied, possibly due to a previous service invocation
   
   Solution: D is true:
   
   E. Using rules we can carry out computations that are impossible to carry out using Java
   
   Solution: E is false:
   
   F. Ensuring the local consistency of participating agents is not adequate for supporting successful collaboration when the agents have nontrivial shared data
Solution: F is true:

G. The Distributed TMS requires that if two agents share a fact \( f_1 \), and each agent uses \( f_1 \) to justify another fact \( f_2 \), then the two agents also share \( f_2 \)

Solution: G is false: there is no requirement that the consequences of a shared fact be shared

H. The Distributed TMS requires that if two agents share a fact \( f_1 \), and one of them justifies \( f_1 \) based on another fact \( f_0 \), then the two agents also share \( f_0 \)

Solution: H is false: there is no requirement that the antecedents of a shared fact be shared

I. Commitments are a useful basis for modeling agents in open settings because autonomous agents violate their commitments only if there is a physical exception such as an earthquake

Solution: I is false:

J. If you offer someone to buy their pencil for $1 and they give you their pencil, then you become unconditionally committed to paying them $1

Solution: J is true: in this case, when they give you the specified pencil that detaches the commitment

K. A (conditional) commitment is discharged when its consequent becomes true

Solution: K is true:

L. A (conditional) commitment is delegated when its consequent becomes true

Solution: L is false:

M. The rejection of an offer corresponds to the release of the corresponding commitment

Solution: M is true:

N. Once a hose seller agrees to provide some hoses for a specified price, it can change the hoses but cannot increase the price; this means the hose seller has the disability to change the price

Solution: N is false: the seller lacks the power to change the price that it could claim from the buyer

O. If Amitai may permit or deny Batalagundu access to the inventory database, then Amitai has immunity from Batalagundu with respect to the inventory database

Solution: O is false: Amitai has power over Batalagundu with respect to Batalagundu’s access to the inventory database

3. (18 points) Problems on communications
A. A web services conversation specifies the allowed orderings of the interactions that a service and its client can carry out

Solution: A is true:

B. A choreography describes an interaction from the local view of each participant

Solution: B is false: a choreography describes an interaction from a global perspective

C. Communications are an important class of interactions because they support the autonomy of the parties involved

Solution: C is true:

D. The three elements of a communicative act are locution, illocution, and perlocution

Solution: D is true:

E. Unlike traditional settings, perlocutions provide the right basis for communicative acts in open, service-oriented settings

Solution: E is false: illocutions provide the right basis for communicative acts in open settings; perlocutions in open settings are potentially unconstrained

F. Unlike in a traditional finite state machine, the states of a commitment machine are specified using logic and each transition corresponds to the meaning of the message that labels the transition

Solution: F is true:

G. In an open environment, two agents might sometimes need to combine their local observations in order to determine that a third agent is complying with its commitments

Solution: G is true:

H. Vector clocks can be used for synchronous messaging provided that when a message is sent, you set the sender and receiver of a message to have the same vector clocks

Solution: H is true: doing so captures the essence of synchrony (this simply shows that vector clocks can mathematically handle synchrony: there is no suggestion here that synchronous messaging is appropriate for open systems)

I. Consider a system of two agents, each of whom sends exactly one message to the other; then when both messages have arrived, the two agents have equal vector clocks

Solution: I is false: in general, each agent would have progressed farther than the other agent knows it has