This homework assignment has 5 problems, for a total of 124 points.

1. (8 points) Basic concepts.
   A. It is better to assume services and business partners are static so as to promote flexibility in an IT system
   B. Locality is the idea of reducing dependencies across services to the extent possible while ensuring coherence
   C. Reputation is an important consideration for selecting a service provider but not for selecting a service requestor
   D. Context only matters when there is high potential cost to the user of a wrong decision by a mobile application

2. (18 points) Agents.
   A. Autonomy goes hand in hand with accountability: a party that is autonomous is the one that can be held accountable for its actions
   B. The persistence of an agent’s identity is crucial to its ability to participate in service engagements
   C. The decomposition of a goal relies upon nothing more than the AND and OR operators explicitly stated within the description of a goal
   D. When we apply cognitive agents to services, we can naturally map an agent’s sensors to services
   E. The IOPE (or IOPR) representation of services does not support planning to compose services
   F. Many of control constructs defined in the OWL-S vocabulary encode a scripting language
   G. An inference rule provides a simple means of progressing from one state to the next
   H. Backward chaining is a control regime for rule-based reasoning that produces bindings, if any, that make its consequent true
   I. Encoding business policies using rules provides a simple means to inspect policies and verify whether an agent (implementation) is applying the appropriate policies

3. (18 points) Multiagent systems and organizations.
   A. The main shortcoming of the mentalist approach (as in FIPA) is that it confuses architecture with implementation
   B. A suitable notion of consistency for a multiagent system is that each of the agents in a system be locally consistent
   C. When a datum is marked EXTERNAL that signifies another agent is the authority regarding whether that datum is IN or OUT
   D. Organizations provide a basis for establishing consistency of service interactions across multiple agents
   E. Modeling virtual enterprises as organizations provides a basis for recovering from business exceptions
   F. A (communicative) convention maps physical actions to social actions
   G. A mentalist semantics for communications is ideally suited to open systems, such as in service-oriented computing
   H. Commitments and operations on them can provide a standard of correctness for the messages in a business protocol such as bid or accept
I. A problem with assigning social meaning to the messages in a business protocol is that it is not possible to determine whether the agents participating in a protocol comply with the social meaning.

4. (20 points) Protocols.

A. The good feature of standard messaging middleware for services is that they make sure two services will always observe any common messages in the same order.

B. An idea behind BSPL is that all the shared information an agent needs to play a role in a protocol is passed explicitly through message parameters.

C. A simple protocol such as Hello does not need a key.

D. In LoST, an agent playing a role may have “too much” information to be able to send a message.

E. To construct protocols for cases such as negotiation (e.g., involving offer and counteroffer messages about price), we must allow certain parameters (e.g., price) to be overwritten for the same key.

F. In our architectural assumptions underlying LoST, an agent who already knows the binding of a parameter is forbidden from receiving a message with an \textit{out} binding of the same parameter.

G. In LoST, an agent can gain or lose knowledge about parameter bindings as it sends and receives messages.

H. A protocol that is safe is guaranteed to complete in all enactments.

I. A protocol that is live is guaranteed to complete in all enactments.

J. The only way an agent learns the binding of a parameter is if it sends or receives a message with that parameter.

5. (30 points) Consider the following protocol for health care services.

\begin{verbatim}
Health Insurance {
    role P, H, I // Patient, Health care provider, Insurance company
    parameter ... Part (a) ...

    P \rightarrow I: apply [in patientID]
    I \rightarrow P: policy [in patientID, out policyID]
    P \rightarrow H: visit [in patientID, in policyID, out problem]
    H \rightarrow P: plan [in patientID, in policyID, in problem, out procedureID]
    H \rightarrow I: verify [in patientID, in policyID, in procedureID]
    I \rightarrow H: approve [in policyID, in procedureID, out approvalID]
    H \rightarrow P: procedure [in patientID, in policyID, in problem, in procedureID, in approvalID, out done]
}
\end{verbatim}

Treat the problem parts below as independent of each other.

(a) (10 points) The above protocol is designed to be composable so that all its parameters are public. State which is \textit{in} and which is \textit{out} so as to complete the parameter line.

(b) (10 points) Modify the above protocol so that the INSURANCE COMPANY may deny a request from a health provider.

(c) (10 points) Modify the above protocol so that the PATIENT may specify a treatment plan, i.e., a desired procedure to be performed by the HEALTH CARE PROVIDER.