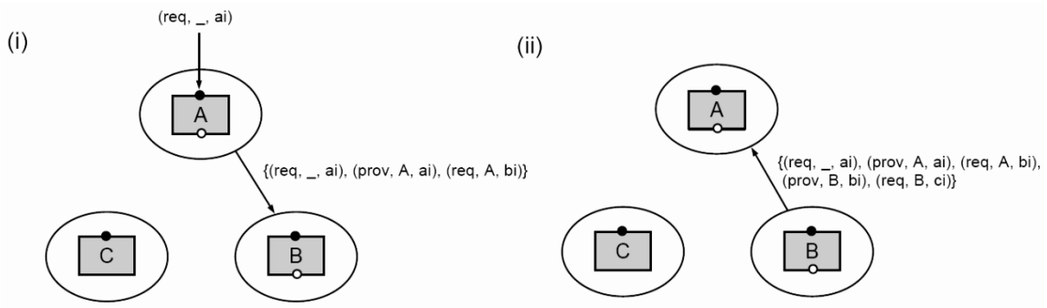
Institute of Information Technology
University of Dhaka
6th Semester Final Examination, 2018
CSE 601: Distributed Systems
Marks: 100 # Time: 3 Hours

Professionalism Excellence Respect

[Answer all of the following questions. When answering a question, please answer all the subsections of it at once]

Mark

1.



Distributed self-assembly is a famous problem in distributed systems that aim to automatically discover the dependencies of all the entities to work collaboratively. In the figure above, entity A eventually finds entity B and resolves its dependency of interface bi. B's interface requires dependency of interface ci. The whole dependency set is passed to A which eventually resolves ci.
Here,
(req,X,xi) indicates X requires the interface xi
(prov,X,xi) indicates X provides the interface xi

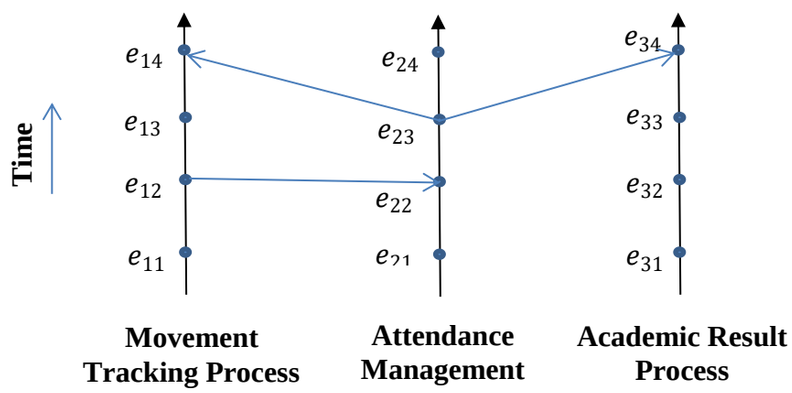
a. What type of communication entity is appropriate for this algorithm? Justify your answer. 2.5

b. What type of communication paradigm is appropriate for this algorithm? Justify your answer. 2.5

c. Explain the role of middleware in these types of systems. 2.5

d. How can an entity eventually find another entity? Complete the remaining steps of this algorithm graphically. 2.5

2. An automated attendance management system is going to be implemented at IIT which will use an movement tracking process to capture two events - entering the class and leaving the class e_{12}. These events will be notified to the attendance management system. After class ends, the attendance management system process will trigger event e_{23} will notify IIT academic result system and fine management system. It will further notify the movement tracking process to stop tracking movement after class.
Consider the following space-time diagram for this system.



a. Draw the architecture for event notification for this system. 3

b. Prove whether the following statements hold. 4
(i) $e_{11} \rightarrow e_{23}$
(ii) $e_{13} \rightarrow e_{23}$
(iii) $e_{11} \rightarrow e_{34}$
(iv) e_{21} and e_{32} are concurrent

c. For this system, describe how you can implement logical clock for event ordering. 3

3. Consider three nodes (i), (ii) and (iii). The IP address of (i), (ii) and (iii) are 27.123.244.0, 27.123.244.4 and 27.123.244.16 respectively. The following code excerpts are from three processes, each residing within the corresponding nodes, with ports 4080, 2560 and 9000 respectively.

```
struct Expression{
  char term[50];
  char power[50];
  unsigned long value;
}
```

(i)

```
public class Expression implements Serializable{
 private String term;
 private String power;

 public Expression(String term, String power) {
    this.term = term;
    this.power = power;
 }

 public int getValue(int value) {
    byte[] arguments = ByteArrayConverter.convert(term, power, value);
    byte[] solution=Stub.doOperation(ReferenceFactory.getRemoteObjReference(), 2,
arguments);
    return ByteArrayConverter.deconvert(solution);
}}
```

(ii)

```
public class Solver implements Serializable{

 public Object solve(String term, String power, String value) {
    Object solution = null;
    //solution goes here
    return solution;
 }
 public int getValue(String term, String power, String value) {
    int value = 0;
    //solution goes here
    return value;
 }}
```

(iii)

a. For struct Expression = {“x 2”, "2 1", 5}, show its CORBA Common Data Representation (CRD). 2.5

b. For Expression expression=new Expression (“x 2”, "2 1"), show the serialized form of (ii) in Java Object Serialization. 2.5

c. Write down the remote object identifier of (iii) and explain the request-reply protocol for the remote method invocation from (ii) to (iii). 5

4. A client attempts to synchronize with a time server It records the round-trip times and timestamps returned by the server in the table below.

Round-trip (ms)	Time (hr:min:sec)
22	10:54:23.674
25	10:54:25.450
20	10:54:28.342

a. Which of these times should it use to set its clock? Justify your answer. 2.5

b. To what time should it set its clock? Explain you answer. 2.5

c. Estimate the accuracy of the setting with respect to the servers clock. 2.5

d. If it is known that the time between sending and receiving a message in the system concerned is at least 8 ms do your answers change? Explain. 2.5

5. Consider that the following remote processes use distributed shared memory.

Process 1	Process 2	Process 2
x= 1;	y=1;	z=1
print(y,z);	print(x,z)	print(x,y)

a. Is using distributed shared memory over message passing in this example advantageous? Briefly explain. 2

b. Mention two execution scenarios where the execution sequences are sequentially inconsistent and consistent respectively. 4

c. Graphically show write-invalidate procedure for this example. 4