CS5352.751/752, Sum II, 2020
Distributed Computing
Final Exam

8:00 pm – 10:30 pm
Thursday, 06-August-2020

General Instructions:

- This is an *open-book* exam. Any books and class notes are allowed.
- **Any form of information exchange or online searching is not allowed during the exam**.
- Solve all three problems.

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Problem	1	2	3	Total
Score				
Maximum	69	16	15	100

1. ($3 \times 23 = 69$ pts) Answer true or false only ($\rightarrow$ is Lamport's happened before relation)

F (1) In a *consistent run*, if it contains an event receiving message m, it must also contain the event that sends the message m.

T (2) *Network virtualization* builds new and more advanced networks to provide more advanced networking services.

F (3) For the *Byzantine General* problem, for any algorithm solving the problem to work, each process must know the IDs of its neighbor processes.

T (4) The so-called *critical section* is a section of common objects that at any time at most one process is allowed to access.

F (5) In solutions to the *critical section* problem, *fairness* means that each process has equal opportunity of entering its critical section.

F (6) If a is the event that sends a message from process P_i to process P_j, and b is the event in P_j that receives the message sent by a, then $a \rightarrow b$ must hold.

F (7) It is possible to have two events a and b that are not ordered by the *Vector clocks* as discussed in class.

T (8) A global state must include at least one state from every process in a distributed system.

T (9) The notion of vector clocks introduces a total ordering on events in a distribute system.

F (10) In NTP the most important factor that affects the accuracy is the total amount of time from the time a message is sent to the time a response of that message is received.

F (11) In NTP the total transmission time of a message can be obtained exactly, but the total delay cannot be obtained.

T (12) Each RPC application has a unique RPC number.

F (13) For Each RPC number there is a corresponding port number and the reverse is also true.

T (14) A remote interface can contain multiple remote objects.

F (15) Java RMI implementation supports location transparent binding method.

F (16) Java RMI supports marshalling and unmarshalling with java compiler.

(17) Each process in the distributed consensus algorithm UM(n,t) studied must know the id of every other process in the system.

F (18) A solution to the *critical section* problem can be used to solve the *Byzantine general* problem.

F (19) A solution to the *Byzantine General* problem can be used to solve the *critical section* problem.

T (20) If $a \rightarrow b$, or $b \rightarrow a$, then a and b are not concurrent events.

F (21) The time complexity of any solution to the *Byzantine General* problem is exponential of n (the number of processes).

F (22) In any true *distributed algorithm* that involves n processes, all n processes must be part of the decision making process.

F (23) In any true *distributed algorithm* that involves n processes, no process has knowledge of global states.

2. ($8 + 8$ = 16 pts)

(1) Describe typical steps of actions (in the correct order) of a “WeatherService" RMI application session.

(2) How does the client and server in a typical Java RMI application perform marshalling and unmarshalling operations? In the “WeatherService" RMI example which file(s) contain code that helps marshalling?

3. ($5 \times 3 = 15$ pts) Mark only one choice that is *most applicable* to the statement. Only one choice is allowed.

(1) About the R, RR, RRA protocols:

a. R, RR, and RRA protocols are based on TCP/IP;

b. TCP/IP are based on R, RR, and RRA protocols;

c. R, RR, and RRA protocols are only applicable to distributed/cloud computing;

d. R, RR, and RRA protocols are only used in middleware layer of distributed/cloud computing;

e. R, RR, and RRA protocols are just some generic protocols.

(2) The notion of *transparency* in distributed computing

a. is a core idea of distributed computing;

b. has evolved to the notion of network virtualization;

c. is no longer important in cloud computing;

d. only choice a and c above are true;

e. items a, b, and c above are all true.

(3) For the *Byzantine General* problem:

a. the number of faulty processes t must be known;

b. each process has to send(forward) the messages it received to other processes;

c. the total number of messages generated is polynomial of n and t;

d. the issuing process can send no message to any processes;

e. all above are false.