NIST **Second Partial** **Units 3,4,5,6 Lab 3** **2023-01-23** **A**

This exam has a value of 10 points, and consists of 24 multiple choice questions. Each question raises 4 alternatives and has a single correct answer. Each correct answer contributes 10/24 points, and each error deducts 10/72 points. You must answer on the answer sheet.

1 *The DEALER-ROUTER communications pattern assumes that the DEALER socket will be used by a client process and the ROUTER socket by a server. If those two processes have not yet exchanged any messages, can the server send the first message to the client using a ROUTER socket for it?*

a Yes, since the ROUTER socket is bidirectional and asynchronous.

b Normally not, because it will not know the identity to use to communicate with the client's DEALER.

c No, because the ROUTER socket will only be able to receive messages.

d Normally yes, although to this end the client should have previously connected its DEALER socket to that ROUTER socket.

2 *Suppose a DEALER socket called* `so1` *is being used by a process P1, which has already been successfully connected to a socket* `so2` *of type ROUTER used by a process P2. P1 uses this statement to send a string to P2: so1.send('hello').*
What code would P2 need in the on() method of its `so2` *socket to write the content ('hello') of that message to the screen?*

a so2.on('message', (m) => console.log(m+”))

b so2.on('message', (i, s, x) => console.log(x+”))

c so2.on('message', (i, j) => console.log(j+”))

d so2.on('data', (m) => console.log(m+”))

3 *In a certain activity of Unit 3 it was requested to develop a chat service with two components: client and server. The client used a PUSH socket and a SUB socket. Besides, the server used a PULL socket and a PUB.*
Could an equivalent implementation of this service be developed using a single ROUTER socket on the server and a single DEALER socket on each client?

a No, because clients would be forced to use bind() on their DEALER and the server wouldn't be able to connect to all of them because it doesn't know their addresses.

b No, because the server does not know which identity the DEALER of each client will use.

c Yes, since both sockets are bidirectional and the server knows how many clients have registered, as well as the identity used by each of their DEALERs.

d No, as the DEALER socket cannot simultaneously emulate the behaviour of a PUSH socket and a SUB socket.

4 *Among other tasks, deploying a distributed service includes:*

a The writing or development of the programs that make up the distributed application whose execution will generate that service.

b The debugging of the programs that make up the distributed application whose execution will generate that service.

c The shutdown of each of the service components, in the proper sequence to avoid inconsistencies during that deactivation.

d All other options are correct.

Consider these Dockerfiles in future Docker-related questions.

```
# Dockerfile A
FROM tsr2223/ubuntu-zmq
COPY ./mytsr.js tsr.js
RUN mkdir broker
WORKDIR broker
COPY ./broker.js mybroker.js
EXPOSE 9998 9999
CMD node mybroker 9998 9999
```

```
# Dockerfile B
FROM tsr2223/ubuntu-zmq
COPY ./tsr.js tsr.js
RUN mkdir worker
WORKDIR worker
COPY ./workerReq.js myworker.js
CMD node myworker $BROKER_HOST 9999
```

5 *Dockerfile A will be used to build an image called 'broker' and Dockerfile B will be used to build an image called 'worker'. There will be no errors in these two operations. If when starting a 'broker' container, its IP address is 192.168.1.5, can any 'worker' container that interacts with that 'broker' container be started later?*

a No, we would have had to replace $BROKER_HOST with 192.168.1.5 before using Dockerfile B to create the 'worker' image.

b No, as both containers would need to be started simultaneously for worker to have some correct value in its BROKER_HOST variable.

c Yes. For example, using the docker-compose command and a docker-compose.yml file in which worker depends on broker and BROKER_HOST is set.

d None of the other options are correct.

6 *If you wanted to use Dockerfile A to build an image called broker, you would need…*

a Run the command

```
docker build -t broker .
```

wherever Dockerfile A is.

b Have a `tsr.js` file where Dockerfile A is.

c Have a `mybroker.js` file where Dockerfile A is.

d All other options are correct.

7 *Consider that the program 'broker.js' mentioned in Dockerfile A uses its first argument as a* **port number** *to interact with client processes. Dockerfile A has generated the image 'broker'. With that image a container will be started on a host whose IP address is 148.52.2.200*
It is also intended to run a client process on a computer whose IP address is 148.52.2.145, which should connect to the mentioned container using the IP address 148.52. 2.200 and port 9998.
With what Docker command should we start that broker-based container so that it interacts without errors with the mentioned client?

a There is no command, since such interaction is not feasible: Docker containers can only communicate with other containers on the same host.

b There is no Docker command for that purpose. To deploy components on more than one computer, Kubernetes should be used instead of Docker.

c

```
docker run -p 9998:9998 broker
```

d

```
docker run broker node mybroker tcp://148.52.2.200:9998 9999
```

8 *Consider this file docker-compose.yml:*

```
version: ’2’
services:
   one:
      image: zzz
      links:
         - two
      environment:
         - SERVER_IP=two
         - SERVER_PORT=8080
   two:
      image: yyy
      expose:
         - "8080"
         - "8443"
```

Determine which of the following statements about that file is FALSE:

a We could start five instances of the ’one’ component and one of the ’two’ component if we used the command

```
docker-compose up -d --scale one=5
```

wherever the file is.

b When doing a docker-compose up where the file is, an instance of component ’two’ will be started first, followed by an instance of ’one’.

c If the images ’zzz’ and ’yyy’ do not exist on the machine where this file will be used, docker-compose up will build them locally.

d The program to be executed in the containers that use the ’zzz’ image uses two environment variables: SERVER_IP and SERVER_PORT.

9 *Containers allow you to deploy a service faster than virtual machines because…*

a They are specifically designed to be deployed on cloud systems.

b They do not have file systems, so they require less space than a virtual machine.

c They don’t need a ’guest’ operating system, so they complete their boot very soon.

d A container manager limits resource usage for host system processes, while a hypervisor cannot do that.

10 *If in a distributed service it is decided to manage possible connectivity failures (that is, network partitions) using the primary partition model, then…*

a In case of network partitioning, all clients of that service will continue to use it and observe that the service is still available.

b Strong consistency, such as sequential, may be maintained in the majority subgroup of nodes, if it exists.

c The deployment of that service will not be possible, since there is no way to detect if communication with other nodes is possible or not.

d Causal consistency cannot be maintained when there are partitions in the network, since what is done in an isolated group of nodes cannot be transmitted to the others.

11 *Which of the following statements about the passive replication model is TRUE?*

a Failures in the primary replica do not require any reconfiguration of the replicated service.

b The failure of a secondary replica can be easily detected by clients of the replicated service.

c Clients of a service replicated under this model will normally receive more than one response for each of the requests made.

d This model tolerates non-deterministic operations because each operation is executed by a single replica and its effects are normally transferred to the others.

12 *A distributed application has been developed whose operations generally require a short computation interval (less than 10 ms), but when they change state each one of them usually overwrites a lot of data (100 MB on average).*
What replication model would you be interested in using to optimize the performance and availability of this service avoiding inconsistency?

a The active one, since it does not need state transfers between the replicas.

b The multi-master, because it can delay state transfers for as long as we want.

c The passive, since its reconfiguration is immediate in case of failure, and that more than compensates for any type of performance loss.

d None. Such a service will get optimal performance with a single instance. It's not worth replicating anything.

13 *In a system there are two processes P1 and P2 that replicate the same variable 'y'. Each access uses the notation operationProcess(variable)value. Which of the following executions would respect the sequential consistency model, but would not respect FIFO consistency?*

a

```
W1(y)4, R2(y)4, W2(y)3, R1(y)3
```

b

```
W1(y)2, W1(y)5, R2(y)2, R2(y)5
```

c

```
W1(y)4, R2(y)4, W2(y)3, W2(y)7, R1(y)7, R1(y)3
```

d None, since any execution that complies with the sequential model will also respect the FIFO model.

14 *On scalable services:*

a Maintaining availability, network partition tolerance, and strong consistency is allowed.

b Availability and strong consistency must be maintained.

c Availability and tolerance to partitioning must be maintained.

d Partition tolerance and strong consistency must be maintained.

15 *Multi-master replication…*

a Has minimal overhead.

b Does not support indeterministic operations.

c Does not allow inconsistencies to arise.

d The remaining clauses are all true.

16 *For a service to be elastic you need…*

a …expert administrators in your deployment who are reviewing your configuration on a daily basis.

b …to have your provider contract a fixed and large number of virtual machines so that you can easily reach its highest degree of scalability.

c …that all its components are programmed using some object-oriented language, as this makes it easier to monitor.

d None of the other options are correct.

17 *In MongoDB:*

a The data is in the mongos processes.

b Mongod manager processes route requests.

c Config servers are mongos processes.

d The remaining clauses are all false.

18 *In the first session of Lab 3, a docker-compose.yml similar to the following one was used to deploy the CBW service:*

```
version: ’2’
services:
   cli:
      image: client
      build: ./client/
      links:
        - A
      environment:
        - C_HOST=A
        - C_PORT=9998
   wor:
      image: worker
      build: ./worker/
      links:
        - B
      environment:
        - D_HOST=B
        - D_PORT=9999
   bro:
      image: broker
      build: ./broker/
      expose:
        - "9998"
        - "9999"
```

What values should be used in it, instead of the A, B, C and D we used here?

a A=cli, B=wor, C=CLIENT, D=WORKER

b A=broker, B=broker, C=BROKER, D=BROKER

c A=worker, B=cli, C=WORKER, D=CLIENT

d A=bro, B=bro, C=BROKER, D=BROKER

19 *In the second part of the first session of Lab 3, it is indicated that we could execute 2 clients, 5 workers and 1 broker by means of the command:*

```
docker-compose up -d --scale cli=2 --scale wor=5
```

Which command, with no additional arguments, will stop and remove all those containers?

a docker-compose down

b docker-compose kill

c docker-compose rm

d None of the other options are correct.

20 *In the second session of Lab 3 a logger component was added to the CBW system deployed in the first session. That involved adding a certain snippet to the corresponding docker-compose.yml file, similar to the following:*

```
log:
   image: logger
   build: ./logger/
   expose:
      - "9995"
   volumes:
      - /tmp/logger.log:/tmp/cbwlog
   environment:
      - LOGGER_DIR=/tmp/cbwlog
```

Was any further extension needed, on the docker-compose.yml file used in the first session of Lab 3?

a Yes, both the ’cli’ component and the ’wor’ component need a ’links:’ clause indicating that they both depend on ’log’.

b Yes, the ’bro’ component needs to add a ’volumes:’ clause with identical content to the one shown here for ’log’.

c Yes, the ’bro’ component needs ’links:’ and ’environment:’ clauses to indicate that it depends on ’log’ and assign values to its environment variables, respectively.

d All other options are correct.

21 *In the second session of Lab 3, some components needed to send their trace messages to a new component, the logger. For that to be possible, it was necessary:*

a Add a socket of type ROUTER in each of them and send a copy of each trace message to the logger with that socket.

b None of the other alternatives are correct.

c Add a socket of type PUB in each of them and send with that socket a copy of each trace message to the logger.

d Add a PUSH type socket in those components and send with that socket a copy of each trace message to the logger.

22 *In the third session of Lab 3, a service with two components, MariaDB and WordPress, was deployed on the same computer. To complete this deployment, we had to:*

a Search for the latest Docker images for those components, modify their Dockerfiles to make them easier to interact with each other, and manually start each container.

b Deploy both components together, using a solution based on Kubernetes, already described in the bulletin.

c Download the docker-compose.yml file indicated in the bulletin and request its deployment with the docker-compose up command.

d Download the docker-compose.yml file indicated in the bulletin, modify some of its clauses and start its deployment with docker-compose start.

23 *In the third session of Lab 3, the sample page offered by WordPress was modified and it was verified that the changes were maintained after stopping the service and starting it again.*
How was this persistence achieved in the changes applied?

a Modifying the corresponding configuration files, to add ’volume:’ clauses in the ’mariadb’ component.

b Modifying the corresponding configuration files, to add ’volume:’ clauses in the ’wordpress’ component.

c Removing a configuration line that set a certain environment variable to ’false’ or changing its value to ’true’.

d There was no need to apply any changes, as the original configuration already used the necessary ’volume:’ sections, with their appropriate values.

24 *To automate the deployment of a distributed service you need:*

a All the components of the service will have been programmed in the same language and will use a similar configuration.

b All other options are correct.

c Have a tool and deployment plan that properly configures all components.

d Have a good system administrator on each machine. They will carefully monitor the configuration and progress of each deployment stage.

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