MAP 1

Question 1. Integration using data-oriented integration and Message Oriented Middleware have one common feature:
  a) Remote processing, involving consumer decoding
  b) The same performance
  c) Strongly coupled between producer and consumer
  d) High development effort always involved

Question 2. Regarding Quarkus framework:
  a) The reactor pattern allows the association of I/O events with Worker Threads
  b) The reactor pattern invokes the event handlers when the expected event is received
  c) The proactor pattern is a synchronous version of the reactor pattern
  d) The proactor pattern allows the association of I/O events with Worker Threads

Question 3. An application built with a microservices framework shall:
  a) Communicate with other microservices and thus allowing a time coupled pattern of communication
  b) Communicate with other microservices and thus allowing a time decoupled pattern of communication
  c) Communicate with other microservices using shared databases
  d) Use a programming model of using service synchronous invocation
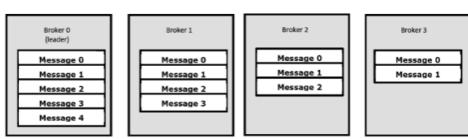
Question 4. The main characteristics of an asynchronous message system, implemented as a cluster, is:
  a) Both the client and the servers must be running simultaneously
  b) The interaction requires a callback
  c) The integration tolerates cluster crash failures
  d) The system tolerates consumer failures but not cluster failures

Question 5. Regarding the context of a microservice framework, which sentence is false?
  a) Microservices are based on the principle that they can be choreographed by a controller service
  b) Microservices supports the implementation related to a business entity
  c) An application based on microservices defines a choreography using its interface
  d) Microservices are highly dependent on an Enterprise Service Bus

Question 6. Consider that a KAFKA cluster is configured to be all in-sync replicas (ISR) mode. A topic has one partition replicated on 4 brokers, accordingly to the figure:

a) Message 3 can be read by a consumer as it is replicated in 50% of the brokers
b) Message 0 can be consumed as it is stored in all brokers
c) Message 2 can be read by a consumer even not replicated in all brokers
d) For improving load distribution, a consumer can read from Broker 1

Question 7. Which component of a Kafka architecture implements the concepts of: Fire-and-forget, Synchronous messages or asynchronous messages:
  a) In-sync replica
  b) Consumer Group
  c) Consumer
  d) Producer

Question 8. The Kafka policy to distribute messages by partition is the following:
  a) Partition Number = hash(key) / #Partitions(broker)
  b) Partition Number = hash(key) % #Partitions(broker)
  c) Partition Number = hash(key) % #Partitions(topic)
  d) Partition Number = hash(key) % #Brokers(topic)

Question 9. The terraform state sharing allows the provisioning of an environment where:
  a) The posterior resources depend on the formers
  b) The formers resources depend on the posterior
  c) The state is *a priori* known, i.e., before execution
  d) The state is known only in the end of all execution

Question 10. What is the result obtained with the following command when executed against a Kafka cluster?
```
/usr/local/kafka/bin/kafka-topics.sh --describe --bootstrap-server ec2-54-221-164-123.compute-
1.amazonaws.com:9092,ec2-54-91-42-183.compute-1.amazonaws.com:9092,ec2-3-90-109-20.compute-
1.amazonaws.com:9092,ec2-18-212-94-70.compute-1.amazonaws.com:9092 --topic PURCHASE
```
  a) describing how a topic has been created in terms of events
  b) describing the current state of a topic in terms of its partitions
  c) describing how a topic has been created in terms of partitions
  d) describing the current state of a topic in terms of its events

Explain what is the purpose of the mechanism of Kafka partition and how should the partitions be defined? Justify, in detail, your answer. Topics are broken down into partitions where each partition is a single log, with the purpose of distributing the storage and computation of a topic that cannot be divided. There is no limitation of creating partitions by each broker. Partitions should be defined accordingly with the definition of available filesystem distribution, the available cpus and network restrictions.

Is it possible to delete or update a message contained in a Kafka Commit log? Why or why not? No, it ´s not possible. Why? a commit log is designed to provide a durable record of all transactions so that they can be replayed to consistently build the state of a system.

What is the mechanism of Quarkus Non-blocking database with pipelining, and explain in detail how does it work? It's a mechanism that enables the shared connection for a database, requiring a for compatible database for that purpose. The following figure explain the components required on I/O thread. In the opposite of blocking, or non- blocking, database, the worker thread and I/O thread are released to further processing until the database finishes the computation and then call-back the I/O thread for end of computation on the Quarkus side.

What is the Kafka Consumer group rebalancing mechanism, and in which conditions should it be executed? Consumers work as part of a consumer group, which is one or more consumers that work together to consume a topic. The group ensures that each partition is only consumed by one member. Additionally, if a single consumer fails, the remaining members of the group will reassign the partitions being consumed to take over for the missing member: Rebalance -> when it is required to execute.

```
Define the following inside resource "aws_security_group" "instance" {
  ingress {
    from_port   = 9095
    to_port     = 9095
    protocol    = "-1"
    cidr_blocks = ["0.0.0.0/0"]
    ipv6_cidr_blocks = ["::/0"]
  }
```

```
The process starts when a technician receives a new prescription.
The process interest involves three participants: Technician, Pharmacist
and Pharmacy System.
First, the technician enters the prescription details. Afterwards, the
pharmacy system performs a drug utilization review. If an alarm is
triggered, then the Pharmacist Perform a Thorough check. Otherwise, the
pharmacy system checks the insurance coverage (3rd party company) to verify
credit.
If drugs are covered by insurance, then the technician collect the drugs
from shelves and the Pharmacist check its quality.
If drugs quality is OK the technician collects the payment and the process
ends.
Otherwise, technician repeats the drugs collection from shelves and the
Pharmacist check its quality again.
```

From the textual description above, what are the microservices that you need to create to support this process model? (IMPORTANT – remember the definition of microservice)
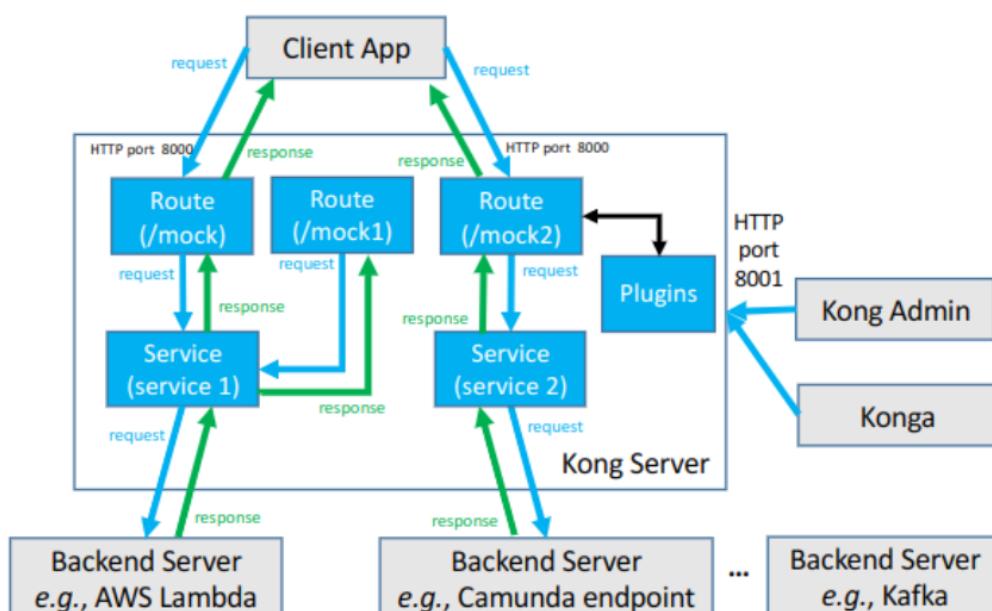
At least the following microservices – aligned with the business entities presented in the textual description: **Technician - CRUD**; **Pharmacist - CRUD**; **Client - CRUD**; **Order – CRUD** – relates the client with drug; **Drug - CRUD;Insurance – CRUD** – relates with client; **Payment – CRUD** - relates with order;

MAP 2

Question 1. Regarding the usage of serverless functions, what is the correct statement?
- a) More difficult to have high availability
- b) Can only be used for synchronous invocations
- c) Long time execution functions are allowed
- → d) Latency on cold starts

Question 2. Regarding the context of a microservice framework, which sentence is false?
- → a) Microservices are highly dependent on a Service-oriented architecture (SOA)
- b) Microservices are based on the principle that they can be choreographed by a controller service
- c) Microservices supports the implementation related to a business entity
- d) An application based on microservices defines a choreography using its interface

Question 3. Regarding the concept of serverless functions, what is the correct statement?
- a) The main objective is to minimize cold starts
- b) There is no server executing the function
- c) It is a model of execution that is founded in on-premises environments and now migrated to the cloud
- → d) The main objective is to reduce the function deployment and instantiation to a minimum

Question 4. Regarding Camunda authentication and authorization, what is the correct statement?
- a) Camunda does not need to have an authenticated user to execute tasks
- → b) Camunda can use an external identity provider
- c) Camunda has not an internal authorization service that enforced authorization based on the role defined in BPMN
- d) Camunda is restricted on invoking external services providing authentication credentials

Question 5. Consider a business service: *Buying a product* on an C2C application. The interface of the service is specified in JSON and uses the REST protocol. The first time a user purchases a good the services require authentication and register that internally. After that, on a second invocation, the service already has the user identity and follows for the purchase. From this simple description chose the best answer:
- a) Loosely coupled and connection oriented
- → b) Loosely coupled and connectionless
- c) Tightly coupled and connection oriented
- d) Tightly coupled and connectionless

Question 6. Regarding the development process of a Business Process oriented approach, what is the most correct statement?
- → a) Business architect model the Business Processes in BPMN, and Software architect create the executable counterparts
- b) Automatically builds a service hierarchy
- c) It produces applications which are more performant than with traditional development
- d) It creates a software application already integrated with legacy systems and external services

Question 7. Which type, or types, of BPMN diagram are supported by the Camunda engine?
- a) Process only
- b) Choreography only
- → c) Process and Collaboration
- d) Process and Choreography

Question 8. From the point of view of an API that is exposing services, what is the most correct statement?
- a) APIs are focused on the governance of services
- b) They must be defined in REST only
- c) SOA enforces the same objective
- → d) APIs expose a business asset that has value for its owner

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- **Cold Start**: The process of initialization of the serverless function, encompassing the extension initialization, the runtime initialization and the function initialization. Everything runs before the invocation of the function.
- **Warm Execution**: The warm execution corresponds to the invocation itself but requires that a previous cold start has been executed

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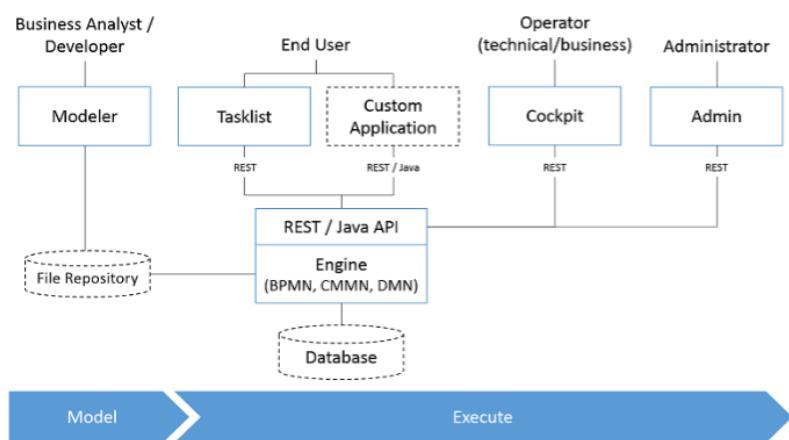
- **Which are the components used to create services?** Kong Admin or Konga

- **If you have a new backend server what is the creation sequence in kong? Create the route, and then, the service or the opposite?** Service first, then route.
- **In this figure, what is the HTTP port used to invoke the Kafka backend server through Kong?** 8000
- **What is(are) the route(s) available to access service 2?** /mock2
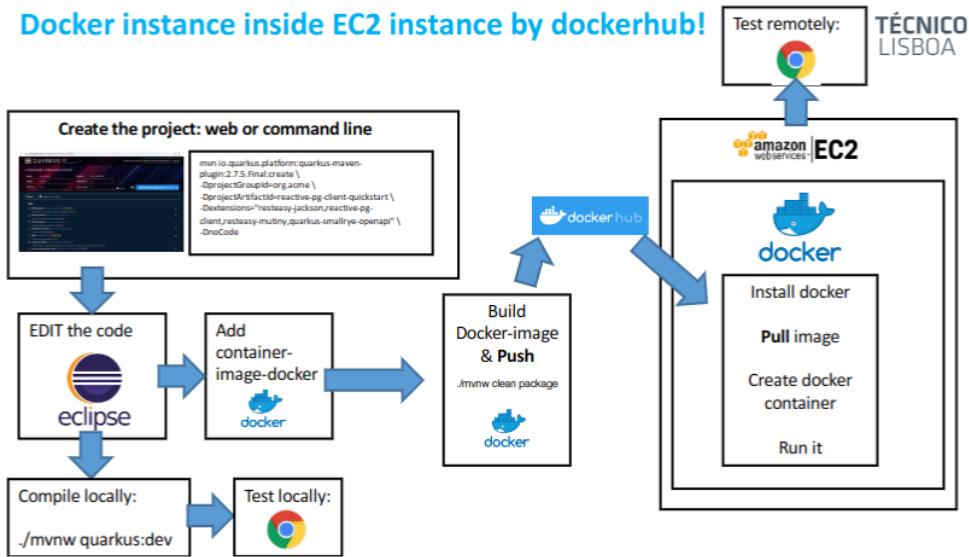
```
HTTP/1.1 201 Created Location: http://royalhope.nhs.uk/slots/1234/appointment
[various headers]
<appointment>
        <slot id = "1234" doctor = "mjones" start = "1400" end = "1450"/>
        <patient id = "jsmith"/>
        <link rel = "/linkrels/appointment/cancel" uri = "/slots/1234/appointment"/>
        <link rel = "/linkrels/appointment/addTest" uri = "/slots/1234/appointment/tests"/>
        <link rel = "self" uri = "/slots/1234/appointment"/>
        <link rel = "/linkrels/appointment/changeTime" uri = "/doctors/mjones/slots?date=20100104&status=open"/>
        <link rel = "/linkrels/appointment/updateContactInfo" uri = "/patients/jsmith/contactInfo"/>
        <link rel = "/linkrels/help" uri = "/help/appointment"/>
</appointment>
```

Explain in detail, what is the purpose of the provided link tags in the appointment? This capability is provided in the maturity level 3 and the purpose is to contextualize and operate the following API Rest requests that can be used after using the API Rest appointment of the slot 1234. The provided requests corresponds to cancellation, other test, change in the appointment, a change in Time, a change in contact information and an endpoint for helping with the appointment.

Considering the CAMUNDA architecture depicted in the following side figure, identify the component (or the components) that is (or are) responsible:

- **To execute a decision table using the DMN notation?** Camunda Engine
- **To create a user to be involved in a business process instance?** Admin
- **To store the history of business process instances history?** Database
- **To assess the state of a business process instance?** Cockpit

How can you use the following four technologies, in the table below, to increase the number of deployed microservices while keeping the limited number of EC2 instances?

- **AWS Accounts**: Dividing EC2 instances by different AWS accounts
- **Docker Images**: Creating less EC2 instances and pulling multiple images to the same EC2 instance
- **RDS Databases**: The bootleneck reported is on EC2 and not RDS. One technology does not replace the other. No impact estimated.
- **Lambda Functions**: Migrating the source code of microservices to lambda functions, and thus, minimizing EC2 instances

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Consider that multiple instances of a given business process are required to be executed concurrently, which is functionality supported by Camunda. Explain, in detail, how the Camunda mechanism can differentiate each instance of the given business process? This is possible by: Correlation ID of a process using Camunda business key (business key in the payload of each API request to start an instance of a business process). Each instantiation provides a correlation ID that is kept while an instance executes. Then, whenever any external activity interacts with the instance it needs to refer to a specific correlation ID