Final Exam

Due Dec 12 at 11:59pm **Points** 45 **Questions** 15
Available Dec 9 at 12am - Dec 12 at 11:59pm 4 days
Time Limit 75 Minutes

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	61 minutes	45 out of 45

Correct answers are hidden.

Score for this quiz: **45** out of 45
Submitted Dec 11 at 5:54pm
This attempt took 61 minutes.

Question 1

3 / 3 pts

One of the primary reasons of failure of Boeing 737 Max 8 was failure of the Angle of Attack sensors. There are two sensors that provide the raw angle data. Only one was used for the MCAS pitch control system. Assume that we had a module that queried both the sensors and if they agreed within an error of 10% then use one of them else do not use any and raise alarm. What kind of context sensor is this?

- Physical sensor
- Logical sensor
- Virtual sensor
- None of the above

Question 2

3 / 3 pts

We are in the age of semi-autonomous cars, where the driver is in control most of the time, but during critical scenarios when the system understands that the driver is incapable of taking actions, the car takes over the decision making. In such a system, consider a brain mobile interface application that assists drivers in a freeway by monitoring their drowsiness. The driver wears a Neurosky headset that senses brain signals (EEG) at 500 Hz. Each brain data point is a 32 bit floating point number. The brain signal is collected by a smartphone and sent to a server, where complex machine learning algorithms are employed to determine the drowsiness level of the driver. In addition, the car is equipped with sensors on the wheel and 360° camera, which are again interfaced with the smartphone of the individual. The data rate from the sensors is 2 kbps, while that from the camera is 200 kbps. Using such data the driver assist system also attempts to predict impending accidents. If the driver is detected to be drowsy and an impending accident is predicted, the driver assist system should react with some actuation, either automatic braking or steering. The driver assist system only has 3 seconds to decide after collecting 5 seconds worth of data. There are two options for performing all the related computation: a) use a data center, and b) use a fog server such as a laptop with internet connectivity that is travelling with the driver. The data center upload speed is 1 Mbps, while that of the fog server is 3 Mbps. However, computation speed of the data center is 750 kbps, i.e., it can finish the computation on 750 kb of data in 1 second, on the other hand the fog server has a computational speed of 400 kbps. **(1 kb = 1024 b)**

What is the computation time for the fog server (write one integer round up to the nearest integer in ms)?

2,720

Question 3

3 / 3 pts

Consider the following scenario: A mobile app (ChargeBuddy) has been developed that an Electric Vehicle owner can use to wirelessly search for a local charging station (CGS). The app lists the nearby CGSs, along with providing relevant information such as current price of charging, and distance from owner’s current location. The EV owner selects the preferred CGS and undertakes responsibility to reach the

chosen CGS within a specified time-period. On reaching the chosen CGS, the EV owner starts charging the EV.

Please answer the following questions on how loss of privacy through hacking of the mobile app can cause the problems for the power grid.

Which action can cause the demand in a particular substation increase beyond the supply cap?

- Increasing price of a given CGS
- Drastically decreasing the price of CGSs in a given area
- Not showing the nearest CGS but showing the second farthest and so on
- Only showing the nearest CGS and not showing others

Question 4

3 / 3 pts

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What is the communication time in cloud server (write one integer round up to the nearest integer in ms)?

1,062

Question 5

3 / 3 pts

What is the drawback of context definition by Relevance?

- [x] Definition is not suitable for modern IoT based applications
- [ ] Definition may ignore certain variables that are essential for the given application
- [x] Definition encompasses all variables essential for the given application but ignores variables that can be used for other applications
- [ ] It restricts context to only measurable variables

Question 6

3 / 3 pts

Is heart rate a valid biometric (select the correct reason also)?

- [ ] Yes, because it comes from human body

- Yes, because heart rate is unique for a given person
- No, because it varies between individuals
- (selected) No, because it varies over time and there is no unique pattern

Question 7

3 / 3 pts

The eternal problem with deep learning systems is the following question:
"How much data do we need to ensure that a deep learning system does not overfit?"

What factors are relevant for an answer to this question?

- (checked) Complexity (number of layers, or number of neurons in a layer)
- (checked) Sensor noise while collecting data
- (checked) Feature extraction methods before providing the input to the deep learning system
- The correctness of class labels

Question 8

3 / 3 pts

Consider a smart phone application that measures your heart rate and summarizes the heart rate variation trend to show it to a doctor. Is this a Cyber Physical System?

- True
- (selected) False

Question 9

3 / 3 pts

Consider the hydro cooling unit of a nuclear power plant that changes the injection rate of cold water based on reaction rate. Is this a Cyber-Physical System?

- (●) True
- ( ) False

Question 10

3 / 3 pts

We are in the age of semi-autonomous cars, where the driver is in control most of the time, but during critical scenarios when the system understands that the driver is incapable of taking actions, the car takes over the decision making. In such a system, consider a brain mobile interface application that assists drivers in a freeway by monitoring their drowsiness. The driver wears a Neurosky headset that senses brain signals (EEG) at 500 Hz. Each brain data point is a 32 bit floating point number. The brain signal is collected by a smartphone and sent to a server, where complex machine learning algorithms are employed to determine the drowsiness level of the driver. In addition, the car is equipped with sensors on the wheel and 360° camera, which are again interfaced with the smartphone of the individual. The data rate from the sensors is 2 kbps, while that from the camera is 200 kbps. Using such data the driver assist system also attempts to predict impending accidents. If the driver is detected to be drowsy and an impending accident is predicted, the driver assist system should react with some actuation, either automatic braking or steering. The driver assist system only has 3 seconds to decide after collecting 5 seconds worth of data. There are two options for performing all the related computation: a) use a data center, and b) use a fog server such as a laptop with internet connectivity that is travelling with the driver. The data center upload speed is 1 Mbps, while that of the fog server is 3 Mbps. However, computation speed of the data center is 750 kbps, i.e., it can finish the

computation on 750 kb of data in 1 second, on the other hand the fog server has a computational speed of 400 kbps. **(1 kb is 1024 b)**

What is the computation time to cloud server in ms?

1,451

Question 11

3 / 3 pts

We are in the age of semi-autonomous cars, where the driver is in control most of the time, but during critical scenarios when the system understands that the driver is incapable of taking actions, the car takes over the decision making. In such a system, consider a brain mobile interface application that assists drivers in a freeway by monitoring their drowsiness. The driver wears a Neurosky headset that senses brain signals (EEG) at 500 Hz. Each brain data point is a 32 bit floating point number. The brain signal is collected by a smartphone and sent to a server, where complex machine learning algorithms are employed to determine the drowsiness level of the driver. In addition, the car is equipped with sensors on the wheel and 360° camera, which are again interfaced with the smartphone of the individual. The data rate from the sensors is 2 kbps, while that from the camera is 200 kbps. Using such data the driver assist system also attempts to predict impending accidents. If the driver is detected to be drowsy and an impending accident is predicted, the driver assist system should react with some actuation, either automatic braking or steering. The driver assist system only has 3 seconds to decide after collecting 5 seconds worth of data. There are two options for performing all the related computation: a) use a data center, and b) use a fog server such as a laptop with internet connectivity that is travelling with the driver. The data center upload speed is 1 Mbps, while that of the fog server is 3 Mbps. However, computation speed of the data center is 750 kbps, i.e., it can finish the computation on 750 kb of data in 1 second, on the other hand the fog server has a computational speed of 400 kbps. **(1 kb = 1024 b)**

Suppose the failure rate of the cloud server is 0.1. This means that 10% of the time the cloud will send a failure message back to the driver assist system. At this time it will have to again transfer all information to

the cloud and redo the computation. The time taken to communicate that a failure has occurred is 210 ms. What is the average total time taken for communication and computation to be performed in the cloud? (write one number and round up to the nearest integer in ms).

2,722

Question 12

3 / 3 pts

What is the data provenance problem?

- (●) It is a problem where data source cannot be identified to be trustworthy
- ( ) It is a data integrity problem where some entity has tampered with the data during wireless communication
- ( ) It is an encryption problem, where data is sent in plaintext and is stolen
- ( ) It is a type of presentation attack where false data is entangled with valid data

Question 13

3 / 3 pts

What are the advantages of Fog server over cloud server?

- [x] Communication to fog server is faster than cloud server

- [ ] fog server has pre-trained machine learning models that can accessed faster than the cloud

- [ ] It is never advantageous to use fog server over cloud. We only use fog server to test applications but in the real world we always use cloud

- [x] Fog servers tend to be more available than cloud servers

Question 14

3 / 3 pts

Consider the fitbit mobile application, that measures your activity, heart rate and sleep and shows it to you. Is this a Cyber Physical System?

- ( ) True
- (•) False

Question 15

3 / 3 pts

Why ingress filtering can cause problems for mobile IP?

- ( ) It introduces inefficiencies and causes delays in communication
- (•) It can potentially prevent legitimate communication
- ( ) It causes message integrity problems
- ( ) It causes man in the middle problems

Quiz Score: **45** out of 45