2021 EXAMINATIONS

Lancaster University

Part II

COMPUTING AND COMMUNICATIONS – On-line Assessment

Available Time **[23 Hours]**

Recommended Completion Time **[3 Hours]**

SCC.306 INTERNET APPLICATIONS ENGINEERING

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*Candidates are asked to answer **THREE** questions from **FOUR**; each question is worth a total of 25 marks.*

Question 1

1.a Web security is an important aspect when designing modern Internet applications.

i. In the context of security threats, match each of the examples below to a threat stage:

a. Blocking a specific malicious traffic flow in the network
b. Updating a piece of mission-critical software to the latest version
c. Monitoring network traffic and pairing this with host-based intelligence
d. Performing a simulated attack on a system and addressing the vulnerabilities

[4 marks]

ii. Consider an Internet-based Bank. They are subject to a Denial of Service (DoS) attack. What do the attackers gain from performing this DoS? Include in your answer the impacts for the bank and its customers.

[4 marks]

iii. Consider an Injection Attack on an online shop, using specifically SQL. Describe what this enables an attacker to do, how this is possible and how it could be prevented.

[3 marks]

iv. Discuss two technical or business impacts that an injection may have, specifically for this online shop. Provide at least two examples.

[4 marks]

1.b Blockchains and Smart Contracts are recent technical innovations.

i. Describe the 4 main functionalities of a Blockchain.

[3 marks]

ii. Explain how Proof-of-Work and Smart Contracts build on the functionality of a Blockchain. Refer to both Bitcoin and Ethereum in your answer.

[4 marks]

1.c Compare HTTP/2 to HTTP/3. Briefly state the main difference between the two versions? Explain why was this change necessary?

[3 marks]

[Total 25 marks]

Question 2

2.a Service Workers run on end devices. What capabilities does each worker offer and why might these be beneficial to a website?

[4 marks]

2.b Intrinsic Web Design is a new way of building layouts for the web. Compare this approach to Responsive Web Design. Include in your answer the example of how a set of content items are displayed on a landing page, each of different sizes. Consider in your answer different screen widths.

[6 marks]

2.c You work at a large software development company. You have been asked by your line manager to insert code into the main codebase that intentionally tracks a user's location and behaviour. This is to be implemented and deployed without alerting them to this change and without their consent.

i. As a professional software developer bound by the ACM code of ethics, what action would take in this case and why? What are the risks involved to yourself and the user?

[4 marks]

ii. In the case of the United Kingdom, would the law protect you if you chose to act? Which law would be used?

[2 marks]

2.d You are an engineer responsible for a popular social media platform. Customers are complaining that the website takes too long to load. You believe that the front-end performance may be the issue.

i. How do you confirm that this is the case? How do you uncover what specifically is to blame?

[5 marks]

ii. Name and briefly describe two methods that can be used to rectify this slow front-end performance.

[4 marks]

[Total 25 marks]

Question 3

3.a You are responsible for running a website that is becoming popular. However, your users are complaining that the website is slow to load and that the experience is poor.

i. State and then briefly describe the most appropriate infrastructure scaling technique to ensure that your website can handle the rapidly increasing volume of traffic. Cost is not an issue. Justify your answer by giving 1 reason why your chosen approach is the most appropriate.

[5 marks]

ii. Name two internal metrics would you use to measure the success of this scaling.

[2 marks]

iii. What would be a minimum time frame for measuring this and why?

[3 marks]

iv. Using only caches and data stores (accessed with APIs), describe how this can be scaled from hundreds of users, to thousands of users, and then to millions of users. Use a diagram to illustrate each step.

[6 marks]

v. You wish to monitor which cache and data store is being used to handle a request. What technique can be used to achieve this, and what changes need to be made to your infrastructure?

[5 marks]

3.b Consider the software testing pyramid. Discuss the relationship between user interface testing and unit tests.

[4 marks]

[Total 25 marks]

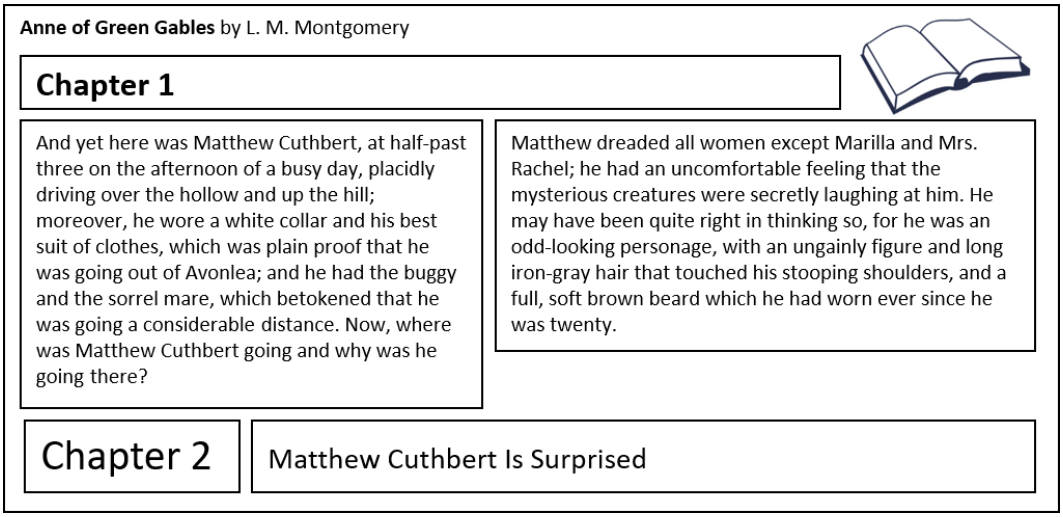
Question 4

4.a Improving the accessibility of a website often involves considering the potential impairments to users. These can be broadly grouped into 4 areas: cognitive, vision, hearing and motor control.

i. Across all 4 groups, what would you considered to be the 3 most common changes that can be made to improve the overall accessibility of a website?

[6 marks]

ii. Consider the following layout for an online eBook reader:



Focusing on cognitive aspects, identify 3 potential changes to improve accessibility. Justify your changes.

[9 marks]

4.b You are responsible for the look and feel of an online shopping website. Your colleague wants to change the colour scheme on a specific page because they believe it will improve sales. How do you go about making this change in a systematic and methodical way? What do you change at each stage? How do you interpret the results of the process?

[10 marks]

[Total 25 marks]

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