



GALWAY MAYO INSTITUTE OF TECHNOLOGY, DUBLIN
RD CAMPUS

Final Year Exam Solutions

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COMP08015 Theory of Algorithms
Bachelor of Science in Computing in Software Development
Department of Computer Science

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Chapter 1

Semester 8 Year 4 Theory of Algorithms

This is a LaTeX document holding The answers/questions from 2014 exam papers to 2019 for the module COMP08015 – Theory of Algorithms. This .pdf acts as a study aid for any student preparing for the 2hr written paper session during May or August(Repeat). Student must answer 3/4 of the questions on the paper.

- Black is Examiners Question
- Blue is my sample answer

1.0.1 Theory of Algorithms - Exam paper 2018-19 Semester 8

1. Question 1 (100 marks)

- Consider the Turing machine given by the following state table.

State	Input	Write	Move	Next
q_0	\sqcup	1	R	q_a
q_0	0	0	R	q_1
q_0	1	1	R	q_0
<hr/>				
q_1	\sqcup	0	R	q_f
q_1	0	0	R	q_0
q_1	1	1	R	q_1

- Determine the number of steps taken by the above Turing machine on each of the four following inputs: , 0101, 11111, and 000000.(40 Marks)
 - my answer
- Define the term big-O in the context of Turing machines.(30 marks)
 - my answer
- Is the language decided by the above Turing machine in O(n)? Explain your reasoning.(20 marks)
 - my answer

2. Question 2 (100 marks)

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- Consider the language $L = \{ i^j \mid i, j \in \mathbb{N}, 0 \leq i \leq j \}$ over the alphabet $A = \{0, 1\}$. (40 marks)
 - my answer
 - When writing automated tests, developers frequently make use of test doubles. Explain what test doubles are and why they are useful. (30 marks)
 - my answer
 -) Describe the role that unit, functional and integration tests play in an automated testing strategy.(30 marks)
 - my answer

3. Question 3 (100 marks)

- In the context of web applications, briefly explain what is meant by the following:(50 marks)
 - Client-Server architecture
 - HTTP is a stateless protocol
 - Scalability
 - ReST API
 - Service-Oriented Architecture
- my answer
- Developers make extensive use of frameworks like Ruby on Rails in developing applications, particularly for the web. Explain what a framework is, and discuss some of the pros and cons of using frameworks(25 marks)
 - my answer
- Ruby on Rails uses the MVC architecture. Explain the role of the 3 main components in this architecture(25 marks)
 - my answer

4. Question 4 (100 marks)

- A major customer of your organisation is using an old product which is built from legacy code. They have requested that a new feature be added, and your manager has asked you to make the required changes to the legacy code, which, unfortunately, has very few tests.
Two possible approaches to this task can be called the Edit and Pray approach and the Cover and Modify approach. Discuss these possible approaches.(30 marks)
 - my answer
- When exploring the legacy code it becomes clear that some of it needs to be refactored. Explain what is meant by refactoring and discuss some of the reasons why code may need to be refactored.(40 marks)
 - my answer
- Briefly explain the four main types of software maintenance. Which type of maintenance did your manager ask you to carry out in the hypothetical task above?(30 marks)
 - my answer

Chapter 2

Semester 8 Year 4 Theory of Algorithms

- Black is Examiners Question
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2.0.1 Theory of Algorithms - Exam paper 2017-18 Semester 8

1. Question 1 (25 marks)

- Explain all the following terms as related to Scrum in an agile environment: (20 marks)
 - Scrum Master
 - Sprint
 - Burndown chart
 - Product Owner
 - my answer
- Explain the benefits of Prototyping when used in the software development process. What is the objective of Throw-away Prototyping? Explain why the throw-away prototype should not be considered as a final system.(40 marks)
 - my answer
- Typical advise to software development teams working in an agile environment would be: “Start with Scrum and then invent your own version of Extreme Programming(XP).” Provide a discussion which contrasts the differences between SCRUM and Extreme Programming(XP).
 - my answer

2. Question 2 (100 marks)

- Briefly describe Two requirement validation techniques.(20 marks)
 - my answer
- An automated ticket-issuing system sells rail tickets. The following is the requirements statement for this ticket-issuing system:

“Users select their destination and input a credit card and a personal id number. The rail ticket is issued, and their credit card charged. When the user

presses the start button, a menu display of potential destination's is activated, along with a message to the user to select a destination. Once a destination has been selected, users are requested to input their credit card. Its validity is checked, and the user is then requested to input a personal id. When the credit transaction has been validated, the ticket is issued.”

Discover ambiguities or omissions in the above statement of requirements for part of a ticket-issuing system. Outline modifications to the requirements to remedy the issues you have outlined.(40 marks)

- my answer
- Using examples outline the differences between Functional and Non-Functional requirements

Write out a set of non-functional requirements for the ticket issuing system in 2b above, setting out its expected reliability and its response time.(40 Marks)

- my answer

3. Question 3 (100 marks)

- “Risks can be ignored in an Agile software development environment” – Discuss (20 marks)
 - my answer
- Discuss some risks that may arise in software projects under TWO of the following headings:
 - Technology
 - Staff
 - Business Impact
 - Customer
 - my answer
- Fixed price contracts may be used to move project risk from client to contractor. Suggest how the use of such contracts may increase the likelihood that product risks will arise.(40 marks)
 - my answer

4. Question 4 (100 marks)

- Identify the maintenance classification of each the following, briefly give your reason for each classification:(20 marks)
 - A database is storing data in a way that it violates Data Protection Legislation.
 - A company has introduced an online system for customers to place orders. The online system needs to be integrated into their normal ordering system.
 - A bank decides to offer a new mortgage product. This will have to be included in the system so that mortgage interest and payments can be calculated.
 - A more advanced touch feedback system is added to a current mobile product.
 - A better data input screen is added to a part of the current system.

-
- my answer
 - Apart from the challenges of heterogeneity, rapid delivery and trust, identify other problems that software engineering is likely to face in the twenty first century. (40 marks)
 - my answer
 - There are circumstances when an organization can decide to scrap a system when the system assessment suggests it is of high quality and high business value. Discuss. (40 Marks)
 - my answer

5. Question 5 (100 marks)

- Briefly explain the following terms as they apply to software testing:(20 marks)
 - Static testing
 - Dynamic testing
- my answer
- Explain why test first development helps the programmer develop a better understanding of the systems requirements.
What are the potential difficulties with test first development?(40 marks)
- my answer
- There are many strategies that can be used to test software. Describe FOUR kinds of tests which should be considered(40 marks)
- my answer

Chapter 3

Semester 8 Year 4 Theory of Algorithms

- Black is Examiners Question
- Blue is my sample question

3.0.1 Theory of Algorithms - Exam paper 2016-17 Semester 8

1. Question 1 (33 marks)

- What are the four most important attributes which all software products should have? Suggest other attributes you consider are important.(7 marks)
 - my answer
- One of the reasons why some apparently simple activities cannot be fully computerised is the need for tacit knowledge. Provide an example of an activity which involves tacit knowledge.(8 marks)

Outline the advantages of retaining some level of human processes within a business system.

- my answer
- Identify the maintenance classification:(12 marks)
 - A database is storing data in such a way that it is causing problems for other systems within the company.
 - A company has introduced a online system for customers to place orders. The online system needs to be integrated into their normal ordering system.
 - A bank decides to offer a new mortgage product. This will have to be included in the system so that mortgage interest and payments can be calculated.
 - A more advanced help system is added to the current system.
 - A better data input screen is added to a part of the current system.
 - An individual bought an incandescent light bulb. The manufacturing company mentioned that the life span of the bulb is 3 years. Just before the 3

years, the individual decided to replace the bulb with a new one.

- my answer
- Under what circumstances might an organization decide to scrap a system when the system assessment suggests it is of high quality and high business value?(6 marks)
- my answer

2. Question 2 (33 marks)

- Outline the reasons why the requirements for a software system may be inconsistent.(7 marks)
- my answer
- Differentiate between Functional and Non Functional requirements? (8 marks)

Which requirements would you consider to be more critical in the software development process? Give a reason for your answer.

- my answer
- (i) Write a set of plausible user requirements for a Login Screen for a GMIT Internet Banking site.(11 marks)
- (ii) Write out a set of non functional requirements for the Login Screen for the GMIT Internet Bank site.
- my answer
- What kinds of errors are sought during requirements validation? (7 marks)
- (ii) Write out a set of non functional requirements for the Login Screen for the GMIT Internet Bank site.
- my answer

3. Question 3 (33 marks)

- Can risks be ignored during agile software development?(7 marks)
- my answer
- Discuss some risks that may arise in software projects under THREE of the following headings.(12 marks)
 - Technology
 - Staff
 - Business Impact
 - Customer
 - Product Size
- my answer

-
- Fixed price contracts may be used to move project risk from client to contractor. Suggest how the use of such contracts may increase the likelihood that product risks will arise.(7 marks)

- my answer

4. Question 4 (33 marks)

- Explain the benefits of Prototyping when used in the software development process.(9 marks)

What is the objective of Throw-away Prototyping?

Explain why the throw-away prototype should not be considered as a final system.

- my answer

- Explain why test first development helps the programmer develop a better understanding of the systems requirements.(7 marks)

What are the potential difficulties with test first development?

- my answer

- Differentiate between the roles of Product Owner and scrum master as related to SCRUM in an agile environment:(10 marks)

Who may terminate a sprint in Scrum outline the circumstances when this may arise.

- my answer

- Typical advice to software development teams working in an agile environment would be:(7 marks)

“Start with Scrum and then invent your own version of Extreme Programming(XP).” Provide a discussion which contrasts the differences between SCRUM and Extreme Programming(XP).

- my answer

5. Question 5 (25 marks)

- Differentiate between static testing and dynamic testing. Describe the key approach used in static testing.(7 marks)

- my answer

- Traceability between requirements and test cases can help to show that the system does what it is intended to do.(7 marks)

What can be done in order to minimise the risk of the system doing what it shouldn't?

- my answer

-
- There are many strategies that can be used to test software. Describe FOUR kinds of tests which should be considered.(12 marks)
 - my answer
 - Discuss which tests should be automated. When is it not suitable to perform automation? (7 marks)
 - my answer

Chapter 4

Semester 8 Year 4 Theory of Algorithms

- Black is Examiners Question
- Blue is my sample question

4.0.1 Theory of Algorithms - Exam paper 2015-16 Semester 8

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Chapter 5

Semester 8 Year 4 Theory of Algorithms

- Black is Examiners Question
- Blue is my sample question

5.0.1 Theory of Algorithms - Exam paper 2014-15 Semester 8

1. Question 1 (34 marks)

- What are the four most important attributes which all software products should have?(7 marks)

Suggest other attributes you consider are important.

- my answer
- One of the reasons why some apparently simple activities cannot be fully computerised is the need for tacit knowledge. Provide an example of an activity which involves tacit knowledge. Outline the advantages of retaining some level of human processes within a business system.(8 marks)

- my answer

- Identify the maintenance classification:

1. A database is storing data in such a way that it is causing problems for other systems within the company.
2. A company has introduced a online system for customers to place orders. The online system needs to be integrated into their normal ordering system.
3. A bank decides to offer a new mortgage product. This will have to be included in the system so that mortgage interest and payments can be calculated.
4. A more advanced help system is added to the current system.
5. A better data input screen is added to a part of the current system.

6. An individual bought an incandescent light bulb.

The manufacturing company mentioned that the life span of the bulb is 3 years. Just before the 3 years, the individual decided to replace the bulb with a new one.(12 marks)

- my answer
- Under what circumstances might an organization decide to scrap a system when the system assessment suggests it is of high quality and high business value?(6 marks)

- my answer

2. Question 2 (33 marks)

- Briefly describe THREE requirement validation techniques.(5 marks)

What kinds of errors are sought during requirements validation(3 marks)

- my answer
- Explain THREE of the following terms in relation to Requirements Engineering:(6 marks)
 - System Requirements
 - User Requirements
 - ViewPoints
 - Stakeholders

- my answer

- An automated ticket-issuing system sells rail tickets. The following is the requirements statement for this ticket-issuing system.

Users select their destination and input a credit card and a personal id number. The rail ticket is issued and their credit card charged. When the user presses the start button, a menu display of potential destination's is activated, along with a message to the user to select a destination. Once a destination has been selected, users are requested to input their credit card. Its validity is checked and the user is then requested to input a personal id. When the credit transaction has been validated, the ticket is issued.

Discover ambiguities or omissions in the following statement of requirements for part of a ticket-issuing system.(7 marks)

Write out a set of non functional requirements for the ticket Issuing system, setting out its expected reliability and its response time.(7 marks)

- my answer
-

-
- Pick THREE plausible user requirements for the ticket-issuing system, Now write THREE test cases which link back to these requirements. These test cases should include instructions and expected results.(5 marks)

- my answer

3. Question 3 (33 marks)

- Can risks be ignored during agile software development?(7 marks)
 - my answer
- Discuss some risks that may arise in software projects under THREE of the following headings.(12 marks)

- Technology
- Staff
- Business Impact
- Customer
- Product Size

- my answer

- A colleague of yours is running a small software company. She has heard of your interest in software management and has asked you how she should proceed in order to introduce risk management in her company.

Give her advice, justifying this advice.(8 marks)

- my answer

- Fixed price contracts may be used to move project risk from client to contractor. Suggest how the use of such contracts may increase the likelihood that product risks will arise.(6 marks)

- my answer

4. Question 4 (33 marks)

- Dissatisfaction with ‘heavyweight’ methods for software development has prompted a number of software developers to use adaptive process models. In the case of the ‘Waterfall’ method, which would be a typical ‘heavyweight’ method, outline the reasons for this dissatisfaction.(8 Marks)

- my answer

- Suggest the most appropriate software process model that might be used as a basis for managing the development of the following systems. Explain your choice.(9 marks)

- Virtual reality system
- University accounting system
- Interactive timetable

- my answer
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-
- Explain the following terms, as related to SCRUM in an agile environment:(10 marks)

- Scrum Master
- Scrum Product Backlog
- Burn Down Chart
- Velocity

- my answer

- Discuss the advantages associated with using Scrum in software projects.(6 Marks)

- my answer

5. Question 5 (33 marks)

- Differentiate between static testing and dynamic testing. Describe the key approach used in static testing.(7 marks)

- my answer

- Traceability between requirements and test cases can help to show that the system does what it is intended to do.

What can be done in order to minimise the risk of the system doing what it shouldn't. ?(7 marks)

- my answer

- There are many strategies that can be used to test software. Describe FOUR kinds of tests which should be considered.(12 marks)

- my answer

- Discuss which tests should be automated. When is it not suitable to perform automation?(7 marks)

- my answer

Chapter 6

References

6.0.1 References

All answers were sourced from notes via www.learnonline.gmit.ie