

Assessment Brief

Academic Year	2023
Semester	2
Module Number	CM1602
Module Title	Data Structures and Algorithms for Artificial Intelligence
Assessment Method	Coursework
Deadline (time and date)	7 th April 2023 5PM
Submission	Assessment Dropbox in the Module Study Area in CampusMoodle.
Word Limit (see Assessment Word Limit Statement)	2000 words
Module Co-ordinator	Malsha Fernando

What knowledge and/or skills will I develop by undertaking the assessment?

The students will gain the knowledge of:

1. Theoretical concepts and main principles of problem solving.
2. Algorithms and data structures
3. Mathematical and logical exercises to test theoretical knowledge.

The students will demonstrate the skill of:

1. Application of the theoretical principles of problem solving to real-world problems using data structures and algorithms.

On successful completion of the assessment students will be able to achieve the following Learning Outcomes:

1. Describe the fundamental concepts of algorithms and data structures.
2. Evaluate algorithms and data structures using the theory of complexity analysis (for performance).

What knowledge and/or skills will I develop by undertaking the assessment?

3. Apply appropriate data structures given real-world problem to meet requirements of programming language API's.
4. Adapt and extend algorithms to real-world problems and address implementation requirements.

Please also refer to the Module Descriptor, available from the module Moodle study area.

What is expected of me in this assessment?

You are to implement Java applications for each one of the below tasks.

Task 1 – Stacks, Queues and Dequeues – 30%

When a share of common stock of some company is sold, the capital gain or may be loss is the difference between the share's selling price and the price originally paid to buy it. This rule is easy to understand for a single share, but if you sell multiple shares of stock bought over a long period of time, then you must identify the shares actually being sold.

A standard accounting principle for identifying which shares of a stock were sold in such a case is to use a FIFO protocol. The shares sold are the ones that have been held the longest. For example, suppose you buy 100 shares at \$20 each on day 1, 20 shares at \$24 on day 2, 200 shares at \$36 on day 3, and then sell 150 shares on day 4 at \$30 each. Then application the FIFO protocol means that of the 150 shares sold, 100 were bought on day 1, 20 were bought on day 2, and 30 were bought on day 3. The capital gain in this case would therefore be $100 * 10 + 20 * 6 + 30 * (-6)$, i.e. \$940.

Write a program that takes as input a sequence of transactions, i.e., transactions occur on consecutive days, 'x' indicating the number of shares and 'y' indicating the unit price assuming suitable data types for the above variables. Given this input sequence, the output should be the total capital gain (or loss) for the entire sequence, using the FIFO protocol.

Marking Scheme

Selection of the data structure – 5 marks

Implementation of the algorithm – 12 marks

Documentation with justifications – 7 marks

Understanding of the theory and concepts – 3 marks

Demonstration of the skills – 3 marks

What is expected of me in this assessment?

Task 2 – Trees, Lists and Iterators – 70%

Part A – 35%

Implement an application that supports a person arranging a group of cards in hand. The simulator should represent the sequence of cards using a single positional list so that cards of the same suit are kept together.

Implement this strategy by means of four in a hand, one for each of the suits of hearts, clubs, spades, and diamonds, from 2 – 10, Jack, Queen, King and Ace, so that adding a new card to the person's hand or playing a correct card from the hand can be done in constant time $O(1)$. Also, you do not need to support Jokers.

Assume the game has 4 players, in each iteration a player is dealt one card, after each dealt, each players' hand is displayed (illustrated below)

First deal

Player 1: 2-Clubs

Player 2: King-Diamonds

Player 3: Jack-Clubs

Player 4: 10-Hearts

Second deal

Player 1: 2-Clubs, King-Hearts

Player 2: King-Diamond, Ace- Spades

Player 3: Jack-Clubs, 3-Diamonds

Player 4: 10-Hearts, 6-Clubs

And so on until the deck is empty. After the final dealt, each players' hand must be sorted in order of the suits received in each dealt, (e.g., Player 1 received Clubs first, then Hearts, so all Clubs must be sorted in value, next Hearts, etc.) and by order of value for each suit, 2 being the lowest and Ace being the highest.

The application should support the following functionalities:

- `addACard(r, s)`: Add a new card with rank `r` and suit `s` to the hand.
- `playACard(s)`: Remove and return a card of suit `s` from the player's hand; if there is no card of suit `s`, then remove and return an arbitrary card from the hand.
- `iterator()`: Return an iterator for all cards currently in the hand.
- `suitIterator(s)`: Return an iterator for all cards of suit `s` that are currently in the hand.

What is expected of me in this assessment?

Marking Scheme

Selection of the data structure – 4 marks

Implementation of the algorithm – 20 marks (5 marks * 4 functionalities)

Documentation with justifications – 5 marks

Understanding of the theory and concepts – 4 marks

Demonstration of the skills – 2 marks

Part B – 35%

Write a spell-checker application that stores a lexicon of words, Y , in a set, and implements a method, `spellChecker(a)`, which performs a spell check on the string a with respect to the set of words, Y . If a is in Y , then `spellChecker(a)` returns a list containing only a , as it is assumed to be spelled correctly in this case. If a is not in Y , then the call to `spellChecker(a)` returns a list of every word in Y that might be a correct spelling of a . Your program should be able to handle all the common ways that a might be a misspelling of a word in Y , including swapping adjacent characters in a word, inserting a single character in between two adjacent characters in a word, deleting a single character from a word, and replacing a character in a word with another character.

Marking Scheme

Selection of the data structure – 4 marks

Implementation of the algorithm – 20 marks (5 marks * 4 functionalities)

Documentation with justifications – 5 marks

Understanding of the theory and concepts – 4 marks

Demonstration of the skills – 2 marks

Extra Credit

Task 3 – 5%

Extra challenge: In Task 2 scenario, consider phonetic substitutions as well, improve the algorithm to cater the requirement.

Marking Scheme

Implementation of the functionality with the expected output – 5 marks

No partial marks are allowed.

What is expected of me in this assessment?

Submission Requirements

*All applications must be completed using **Java language only**.*

Task	Submission Requirements	Assessed Learning Outcome	Submission Deadline
1	a) Application java file	3	Formative assessment submission – Week 8
2-A	a) Application java file	3	Formative assessment submission – Week 9
2-B	a) Application java file	3	Formative assessment submission – Week 10
1, 2-A, 2-B and 3 (if attempted)	a) Application java files for each task separately b) One report explaining and evaluating the appropriateness of the algorithms and the data structures used to implement the solutions of tasks 1, 2-A, and 2-B (and Task 3 if attempted only) along with necessary code snippets.	3,4	Summative assessment submission – Week 12

Coursework Report Format

Your report should be word-processed, using Times New Roman, font size 11 or 12, 1.5 line spaced, referenced, and uploaded as ONE final document to the Assessment drop box in the Assessment area of the Moodle page **as a PDF file**.

Structure

The report should be written in a business format using numbered headings/sub-headings it should contain the following:

- Title Page
- Executive Summary

What is expected of me in this assessment?

- Contents Page
- Main Discussion – refer to the content specified in the above table to guide.
- Conclusions & Recommendations
- Reference List
- Appendices (if required – 6 pages maximum)

Submissions must be titled using your RGU Student ID number.

e.g., 2XXXXXX.java and/or 2XXXXXX.pdf

For any duplicating files (applicable for the final submission), identify the task number along with your RGU Student ID.

e.g., 2XXXXXX_Task1.java and/or 2XXXXXX_Report.pdf

How will I be graded?

A grade will be provided for each criterion on the feedback grid which is specific to the assessment.

A	At least 50% of the feedback grid to be at Grade A, at least 75% of the feedback grid to be at Grade B or better, and normally 100% of the feedback grid to be at Grade C or better.
B	At least 50% of the feedback grid to be at Grade B or better, at least 75% of the feedback grid to be at Grade C or better, and normally 100% of the feedback grid to be at Grade D or better.
C	At least 50% of the feedback grid to be at Grade C or better, and at least 75% of the feedback grid to be at Grade D or better.
D	At least 50% of the feedback grid to be at Grade D or better, and at least 75% of the feedback grid to be at Grade E or better.
E	At least 50% of the feedback grid to be at Grade E or better.
F	Failing to achieve at least 50% of the feedback grid to be at Grade E or better.
NS	Non-submission.

Feedback grid *Add more rows/criteria if necessary, up to a maximum of 8.*

GRADE	A	B	C	D	E	F
DEFINITION / CRITERIA (WEIGHTING)	EXCELLENT Outstanding Performance	COMMENDABLE/VERY GOOD Meritorious Performance	GOOD Highly Competent Performance	SATISFACTORY Competent Performance	BORDERLINE FAIL	UNSATISFACTORY Fail
Task 1 (30 %) Grade: <input type="text"/>	All requirements fulfilled without any exceptions. Excellent use of data structures and documenting of the algorithm/s with good justifications. Exceptional understanding of the concepts and demonstration of the skills acquired.	Almost all requirements fulfilled without any exceptions. Good use of data structures and documenting of the algorithm/s with fair number of justifications. Good understanding of the concepts and demonstration of the skills acquired.	Almost all requirements fulfilled with minor exceptions. Appropriate use of data structures and documenting of the algorithm/s with some level of justifications. Good understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled with some exceptions. Use of data structures and documenting of the algorithm/s but contains gaps and lacks logical explanations and justifications. Some understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled with major exceptions. Use of data structures and documenting of the algorithm/s but no logical explanations and justifications. Lacks understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled or no submission.
Task 2 (35 %) Grade: <input type="text"/>	All requirements fulfilled without any exceptions. Excellent use of data structures and documenting of the algorithm/s with good justifications. Exceptional understanding of the concepts and demonstration of the skills acquired.	Almost all requirements fulfilled without any exceptions. Good use of data structures and documenting of the algorithm/s with fair number of justifications. Good understanding of the concepts and demonstration of the skills acquired.	Almost all requirements fulfilled with minor exceptions. Appropriate use of data structures and documenting of the algorithm/s with some level of justifications. Good understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled with some exceptions. Use of data structures and documenting of the algorithm/s but contains gaps and lacks logical explanations and justifications. Some understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled with major exceptions. Use of data structures and documenting of the algorithm/s but no logical explanations and justifications. Lacks understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled or no submission.

GRADE	A	B	C	D	E	F
DEFINITION / CRITERIA (WEIGHTING)	EXCELLENT Outstanding Performance	COMMENDABLE/VERY GOOD Meritorious Performance	GOOD Highly Competent Performance	SATISFACTORY Competent Performance	BORDERLINE FAIL	UNSATISFACTORY Fail
Task 3a (35 %) Grade: <input type="text"/>	All requirements fulfilled without any exceptions. Excellent use of data structures and documenting of the algorithm/s with good justifications. Exceptional understanding of the concepts and demonstration of the skills acquired.	Almost all requirements fulfilled without any exceptions. Good use of data structures and documenting of the algorithm/s with fair number of justifications. Good understanding of the concepts and demonstration of the skills acquired.	Almost all requirements fulfilled with minor exceptions. Appropriate use of data structures and documenting of the algorithm/s with some level of justifications. Good understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled with some exceptions. Use of data structures and documenting of the algorithm/s but contains gaps and lacks logical explanations and justifications. Some understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled with major exceptions. Use of data structures and documenting of the algorithm/s but no logical explanations and justifications. Lacks understanding of the concepts and demonstration of the skills acquired.	Some requirements fulfilled or no submission.
Extra Credit Task 3b (5 %) Grade: <input type="text"/>	All requirements fulfilled without any exceptions. Appropriate use of data structures and clear understanding of the implemented solution.					

Coursework received late, without valid reason, will be regarded as a non-submission (NS) and one of your assessment opportunities will be lost.

What else is important to my assessment?

What is plagiarism?

"Plagiarism is the practice of presenting the thoughts, writings or other output of another or others as original, without acknowledgement of their source(s) at the point of their use in the student's work. All materials including text, data, diagrams or other illustrations used to support a piece of work, whether from a printed publication or from electronic media, should be appropriately identified and referenced and should not normally be copied directly unless as an acknowledged quotation. Text, opinions or ideas translated into the words of the individual student should in all cases acknowledge the original source" ([RGU 2022](#)).

What is collusion?

"Collusion is defined as two or more people working together with the intention of deceiving another. Within the academic environment this can occur when students work with others on an assignment, or part of an assignment, that is intended to be completed separately" ([RGU 2022](#)).

For further information please see [Academic Integrity](#).

What is the Assessment Word Limit Statement?

It is important that you adhere to the Word Limit specified above. The Assessment Word Limit Statement lists what is included and excluded from the word count, along with the penalty for exceeding the upper limit.

What if I'm unable to submit?

- The University operates a [Fit to Sit Policy](#) which means that if you undertake an assessment then you are declaring yourself well enough to do so.
- If you require an extension, you should complete and submit a [Coursework Extension Form](#). This form is available on the RGU [Student and Applicant Forms](#) page.
- Further support is available from your Course Leader.

What else is important to my assessment?

What additional support is available?

- [RGU Study Skills](#) provide advice and guidance on academic writing, study skills, maths and statistics and basic IT.
- [RGU Library guidance on referencing and citing.](#)
- [The Inclusion Centre: Disability & Dyslexia.](#)
- Your Module Coordinator, Course Leader and designated Personal Tutor can also provide support.

What are the University rules on assessment?

The University Regulation '[A4: Assessment and Recommendations of Assessment Boards](#)' sets out important information about assessment and how it is conducted across the University.