Assignment 2: *Binary Search Tree and Directed Graph*

This assessment contributes **30%** of the overall marks for the module **DA3306 DATA STRUCTURES AND ALGORITHMS.** This is a **group** assignment with 2 students with one group ending up with 3 students. Students are not allowed to share their answers (actual coding) but are allowed to discuss general point of views with each other.

This assignment is divided into 2 main tasks. The first task is to implement a Binary Search Tree and the second task is to implement Directed Graph.

In the first part of the assignment, students are required to modify existing Binary Tree methods and change it to Binary Search Tree. In general, in Binary Search Tree, nodes on the left side of the trees are always lower than the parent node and right node of the tree.

In second part of the assignment, students are required to implement a Directed Graph data structure. The Directed Graph is a graph in which the edges have a direction. The specifics of the requirements are in the Task Checklist section.

Students are also required to produce a report containing the differences between implementations. Students are also to provide descriptions for each new method created and the output for all test conducted in this assignment.

On the day of submission, students are required to hand in a softcopy version of the report and source codes to the lecturer. The softcopy versions should be submitted on LMS. Students are required to demo their work after the submission.

Weightage
30%

Due Date
11:59 P.M, 23rd April 2022
(Saturday)

Late Submission
Deliverables received after 11:59 P.M. will result in the deduction of 10% each day and will continue to reduce accordingly.

Deliverables:
Report Softcopy and source codes.
Submission through LMS.

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Resource
Students own research
Lecture slides & DSA portal.

Equipment/Software
Students are required to use their own personal computer and necessary software.

Task Checklist

Please read the following for a detailed explanation regarding what you need to do to complete this assignment. If you have any questions regarding the content, kindly request assistance from your respective module lecturers for further understanding. You are required to submit a **softcopy version** of the **report and source code**.

1. **Report**

The cover page of this report should contain the template provided on the LMS. The contents should follow the following format:

- Table of content
- Documentation:
  - ➢ **Introduction** - Introduction on the topic. The breakdown of the report's content.
  - ➢ **Binary Search Tree** – Description of Binary Search Tree. Differentiate between binary search tree and binary tree. Explain all the methods implemented with the aid of diagrams if necessary.
  - ➢ **Directed Graph** – Description of Directed Graph. Determine the differences between the directed graph and undirected graph. Explain all the methods implemented with the aid of diagrams if necessary.
  - ➢ **Conclusions** – Summary of important points from your report. Discussion on the benefits of the data structure created.
- References - Table (uses APA format and contains resources used as references in this report)

2. **Source Code**

Your source code must contain the following:

2.1 Binary Search Tree

The following methods must be implemented for Binary Search Tree:

1. Insert(items) – This will add new item to the tree.
2. Delete(item) – This will delete nodes that match the items. Note: Take into consideration when deleting a parent node.
3. deleteMax() – This will delete the maximum value in the tree and return the deleted item.
4. deleteMin() – This will delete the maximum value in the tree and return the deleted item.
5. Search(item) – This will return Boolean result indicating whether the item is found within the tree.
6. getHeight() – This will return the depth of the tree.
7. Inorder() – This will print all the nodes in the tree in ascending order.
8. getParent(item) – This will return the parent value of the item.

9. getChild(item) – This will return the child value of the item.

Notes: All the main methods implemented in Undirected Graph must also be implemented in Directed Graph.

2.2 Directed Graph

The following methods must be implemented for Directed Graph:

1. Add(items) – This will add new item to the graph.
2. AddEdges(item1, item2) – This will add edge from item1 to item2. This will create connection where item1 points to item2.
3. Search(item) – This will return Boolean result indicating whether the item is found within the graph.
4. getEdges(m) – This will return all the nodes connected to node m.
5. Size() – This will return the number of nodes in the graph.
6. isPath(m, n) – This will return true if there is a path from point m to point n
7. findAllPath(m, n) – this will return all paths that connected m and n
8. isCyclic() – This will return true if there's a cycle in the graph.
9. allConnected() – This will return true if all nodes in the graph are connected.

Notes: All the main methods implemented in Undirected Graph must also be implemented in Directed Graph.

2.3 Testing

All the methods implemented must be tested. Sample output and input should be clearly included in the codes. For each method, there must be at least one input and output.

3. Demo

For demo, students are required to show and explain their codes to the lecturer. No presentation slides required.

General Guidelines:

- Presenters will have **a maximum of 20 minutes** to demo their work.
- A question-and-answer session will be at the end of the demo.

Assessment Rules

1. Plagiarism is a serious academic offence. You will be penalized heavily if caught plagiarizing. You must take necessary steps in ensuring your work is plagiarism-free. **For severe cases of plagiarism, grade 'F' (Fail) will be awarded. Zero marks will be recorded for your first attempt. The same applies to collusion.**

2. If you have problems in completing the assessment due to illness, you must **REPORT** to the lecturer immediately. Last minute notification will not be entertained unless student presents a medical report, which is issued and endorsed by any government health centres.

3. In the event you are unable to complete the assessment or submit partially completed assessment, the following actions will be taken:

   a. For **significantly incomplete** assessments or **non-submission**, you will be automatically awarded with grade 'F' (Fail). You will be asked to complete the assessment however as a **second attempt**. Marks will be capped at 50%.

   b. For submission of **partially completed** assessment, marks will be awarded as per work submitted. Should marks fall below the passing grade, you will be referred to case 3a above.

4. It is your responsibility to check the LMS regularly for any new updates or announcement. Do not simply rely on your friends to get updates.

5. Rules may be updated from time to time. Any updates will be posted on the LMS.

Report Writing Instructions

- Presentation of report including spelling, grammar, syntax and style will be marked.
- Please remember that your report should be formatted according to the **APA Style Referencing guide** and follow all rules stated in the criteria section.
- Your report must be a word processing document including cover page, table of content, references and appendices.
- Cover page must include the module code, module name, title of the assignment, semester and academic session, student's full name, student ID code, programme title, submission date, module lecturer full name and Politeknik Brunei logo only.

- Use of **12-POINT FONT**, the **ARIAL** or **TIMES NEW ROMAN** font, single or **1.5** spaces, and **PAGINATE**.

- Penalty of marks will be applied if it does not follow this specific format. Kindly note that the cover page must be pasted on top of the folder.

- Assessment must be submitted by the due date and time shown. **Late assessment will be penalized to 10% deduction of the total possible marks for the assessment for every working day after the deadline.** Where the assessment is submitted more than one week late, a mark of zero shall be awarded.

- **It is the student's responsibility to ensure no aspect of their work is plagiarized or the result of other unfair means.**

Deliverables

The list below is the deliverable each group MUST submit. In the case that deliverables received on the submission date after 11:59 P.M., marks will be deducted by 10% each day and will continue to reduce accordingly. More than 10 days would result in automatic failure and will be given a second attempt for this assignment with barring marks.

- Report Document (in PDF format)
- Source code – python script format (.py)
- Presentation Slides (in PDF format – 1 slide per page)

Important Note:

1. Document should be renamed according to the format:
2. DSA-AS2-StudentId1-StudentId2-StudentId3.pdf, Example: DSA-AS2-19FTT2020-19FTT2021-19FTT2022.pdf
3. Only one (1) PDF file is needed for PBLMS online submission.
4. Students are advised to check on the document before submission. A penalty of up to 30% marks deduction for submission of corrupted files.
5. No hardcopy submission is required for this assignment.
6. In the event of technical error in submission, the module lecturer will contact you to resubmit. The corrected version MUST be submitted within one (01) working day. Students are encouraged to keep a copy for resubmission ready.
7. Although the submission date is on **23rd April 2022**, students are strongly advised to consult your lecturer on weekly basis to keep you on the right track and detect any errors so amendments and corrections can be made at early stage before furthering the work.

Lecturer is there to guide students, not to provide the solution. Some of the contents require for this assignment will not be available in the early lectures so students are expected to use their own time to do research in advance and to make sure they are on schedule.

Grading Criteria

Table below is the guideline on how this assessment will be graded.

Task	100%	Guide to score full marks
Report - 32%		
Report Structure	2	Proper cover page as instructed in this assignment brief. Includes: table of content, proper font, font size, spacing and page numbering.
Introduction	3	• Introduction on the topic • Breakdown of report
Binary Search Tree	10	• Description of Binary Search Tree. • Differentiate between binary search tree and binary tree. • Explain all the methods implemented with the aid of diagrams if necessary.
Directed Graph	10	• Description of Directed Graph. • Determine the differences between the directed graph and undirected graph. • Explain all the methods implemented with the aid of diagrams if necessary.
Conclusions	5	• Summary of important points from your report. • Discussion on the benefits of the data structure created.
Reference	2	Proper indication on the text/paragraph where a concept, explanation or solution are taken or reference from. A table of references following APA standard referencing.
Implementations – 53%		
Binary Search Tree	24	• Main methods are implemented • All methods are correctly implemented

		• No errors in source codes
Directed Graph	24	• Main methods are implemented • All methods are correctly implemented • No errors in source codes
Test	5	• At least one simple input and sample output for all methods.
Demo – 10%		
Demo	10	• Able to explain all of the features without difficulty. • Able to answer all questions posed by the audience without difficulty.
Peer Assessment – 5%		
Peer Assessment	5	• Co-operative group member • Overall engagement in group • Task completed within given time • Contributions to the group • Overall, a valuable teammate

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