UNIVERSITY OF OTAGO EXAMINATIONS 2021

COMPUTER SCIENCE

Paper COSC242

Algorithms and Data Structures
Semester 2

(TIME ALLOWED: THREE HOURS)

This examination comprises 7 pages.

Candidates should answer questions as follows:

Candidates must answer **all** questions.
Questions are worth various marks are shown thus: (5)
The total number of marks available for this examination is 100.
In general, if there are two marks for an answer, you should have two things to say.

The following material is provided:

Appendix A: cases for insert violations of red-black trees.
Appendix B: cases for delete violations of red-black trees.
Appendix C: Djikstra's Algorithm

Use of calculators and other material:

The academic integrity policies for this exam are as specified in the notice on the next page, except that course notes, textbooks, personal notes or calculators are authorised for use. Any model of calculator may be used. However, all answers must be your own working and/or your own words.

Other instructions:

You may complete your answers by hand or by using a wordprocessor or similar. In either case, please submit your answers as a *single PDF file* via Blackboard.

UNIVERSITY of OTAGO

Te Whare Wānanga o Otāgo

NEW ZEALAND

Online Assessment

Academic Integrity Notice

IMPORTANT - PLEASE READ

The purpose of this notice is to ensure you understand academic integrity expectations in relation to online tests and examinations.

The following actions are not permitted when sitting online tests or examinations:

- Accessing or viewing unauthorised materials (e.g. course notes, textbooks, personal notes, information on the internet)*
- Using any unauthorised device or computer application (e.g. calculators, mobile phones, computer programs)*
- Communicating with any other person (except to report technical difficulties to a University staff member or representative)
- Having someone else complete any part of the assessment for you
- Copying pre-prepared text as answers
- Exceeding the specified time limit for the assessment

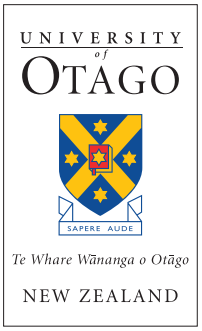
** Please note that use of some materials and devices may be approved for particular assessments; these restrictions only apply to unauthorised use.*

The University may use plagiarism detection software and other technologies to ensure adherence with assessment rules.

Failure to follow assessment rules is subject to penalty under the University's *Academic Statute* and *Student Academic Misconduct Procedures*. Such penalties may include a zero mark for the assessment; disqualification from the paper; cancellation of other passes achieved in the semester; or exclusion from the University.

By completing this assessment, you are taken to have read and understood this notice.

TURN OVER



Online Assessment

IT HELP NOTICE

IMPORTANT - PLEASE READ

In the event of experiencing IT or other technical problems during any part of this examination, immediately contact AskOtago via

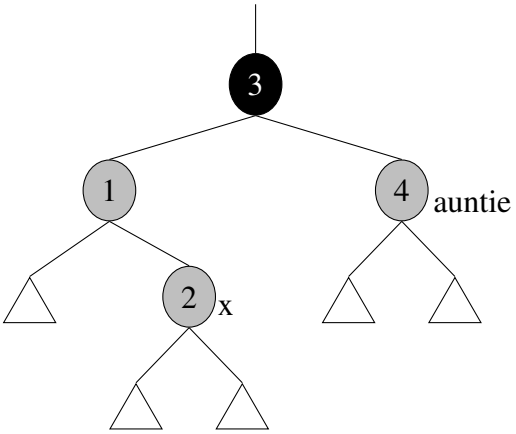
online chat at `https://otago.custhelp.com/`

or phone toll-free in NZ: 0800 80 80 98

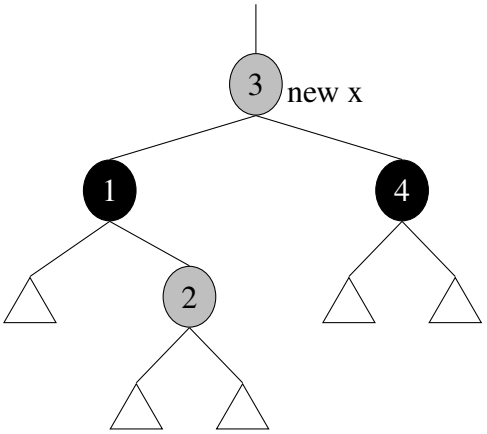
Appendix A: Violations for insertions into red-black tree

Case 1: x's auntie is red

Initial:

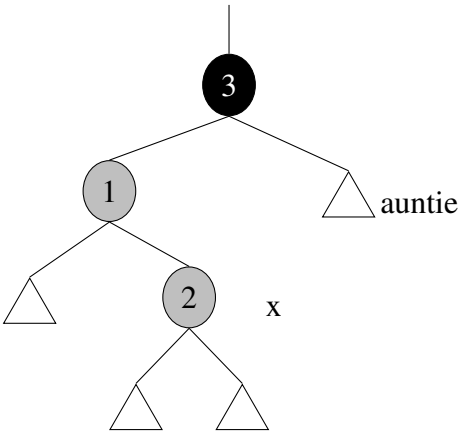


Fixup:



Case 2: x's auntie is black and x is an inner child.

Initial:



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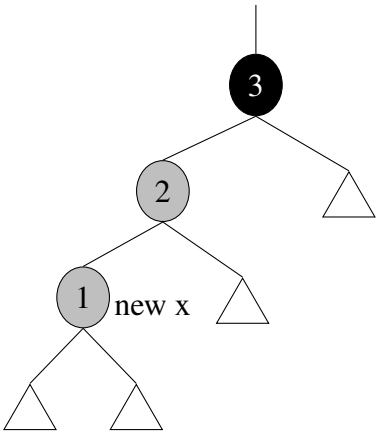
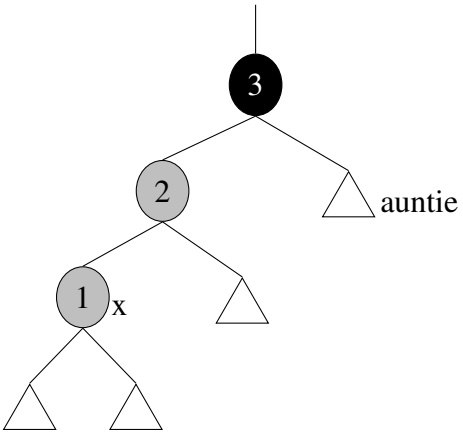


Case 3: x's auntie is black and x is an outer child

Initial:



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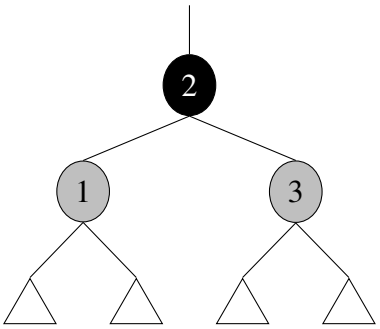
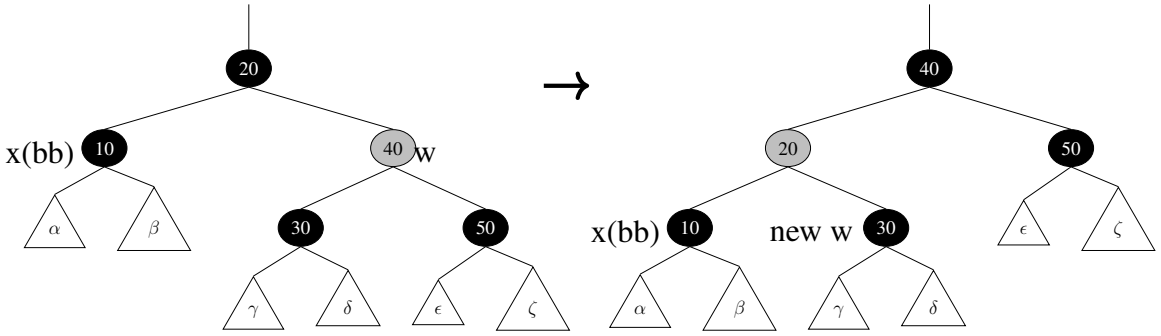


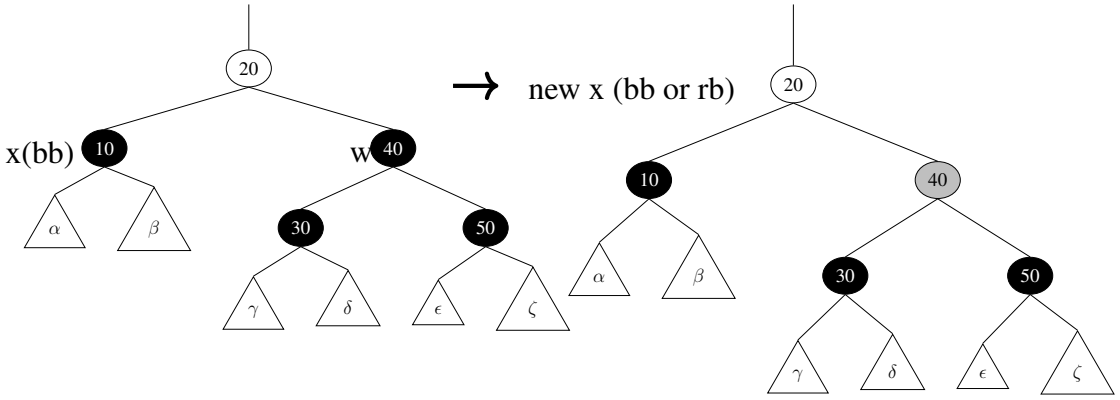
Appendix B: Violations for deletions into red-black tree

Note: unshaded nodes could be red or black.

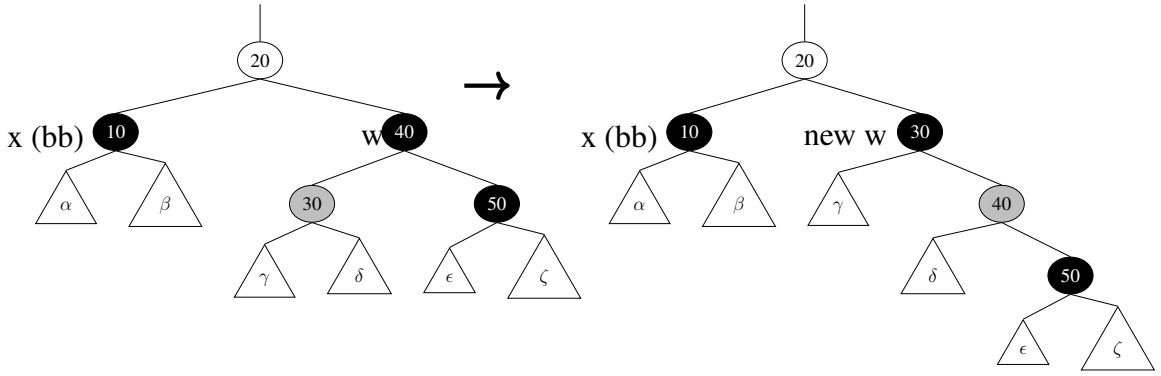
Case 1: x's sibling w is red



Case 2: x's sibling is not red and has two black children



Case 3: w's inner child is red and outer child is black



Case 4: w's outer child is red