

You are advised to submit typewritten (11 point font, 1 inch margins) responses unless you have very clear handwriting. Your responses must be well-written and precise. You will lose points for convoluted writing. You must submit your work by 11:00am on Monday, 2nd April, 2001. If you can't find me, submit your work to Brenda or someone else in the department office. If you submit electronically, make sure you submit a PDF file that can be viewed and printed using the `gv` program on the junkfood machines.

Each question below is worth 10 points (although some questions are much easier than others). In the following, AHV, HK, and ABS refer to [AHV95], [HK01], and [ABS99], respectively.

1. Using the functional language described in Section 6.4 of ABS, write a function that transforms a data graph as follows: All occurrences (in data values, not labels) of the string *data base* that are reachable from the root by a path matching the path expression `univ.*(dept|school).*computer` are replaced with the string *database*. Illustrate the operation of your function on an example that exercises all components of your function (in a sense analogous to code coverage).
2. What is the relation between simulations and bisimulations (as described in ABS)? Justify your answer and illustrate it using examples.
3. Solve Exercise 8.11 from HK. Your description of the proposed method should be detailed enough to enable a proficient programmer to implement it without difficulties. Justify your design choices. Indicate the advantages and disadvantages of your method and include a discussion of the running time.
4. Itemize, briefly, the key differences between Lore query processing and standard relational query processing. Indicate three query execution mechanism from [Gra93] that can be used in Lore with little or no change and another three that require major changes (or are completely inapplicable). Justify your answers.
5. Solve Exercise 5.5 from AHV.
6. Solve Exercise 5.17 from AHV.
7. Solve Exercise 5.29 from AHV.
8. Solve Exercise 6.12 from AHV.
9. Solve Exercise 6.20 from AHV.
10. Solve Exercises 6.24 and 6.27 from AHV.
11. Solve Exercise 6.28 from AHV.

12. Solve Exercise 12.5 from AHV.
13. Solve Exercise 12.12 from AHV. Although the required results follow trivially from some theorems in later chapters of the textbook, here you are required to prove them without using that machinery.
14. Solve Exercise 12.14 from AHV.
15. Solve Exercise 12.27 from AHV.

References

- [ABS99] Serge Abiteboul, Peter Buneman, and Dan Suciu. *Data on the Web: From Relations to Semistructured Data and XML*. Morgan Kaufmann, first edition, October 1999.
- [AHV95] Serge Abiteboul, Richard Hull, and Victor Vianu. *Foundations of Databases*. Addison-Wesley, 1995.
- [Gra93] Goetz Graefe. Query evaluation techniques for large databases. *ACM Computing Surveys*, 25(2):73–169, 1993.
- [HK01] Jiawei Han and Micheline Kamber. *Data Mining: concepts and techniques*. Morgan Kaufmann, San Francisco, California, 2001.