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This homework is based on topics mostly from Chapters 12–15 of [AHV95]. Please submit your work electronically as a PDF file named using the scheme `LastnameIJ-hw2-NNNN.pdf` (replacing `LastnameIJ` with your last name and initials, and `NNNN` with a 4-digit number) by anonymous FTP upload to `ftp.cs.umd.edu`, directory `/incoming/chaw/724`. The exercise numbers below refer to [AHV95].

1. (20 pts) Solve Exercise 12.12(a).
2. (20 pts) Solve Exercise 13.7.
3. (20 pts) Solve Exercise 13.14.
4. (10 pts) Solve Exercise 14.6. Hint:  $G$  and  $G'$  are directed and not necessarily strongly connected. Universal quantification over an empty set yields true.
5. (10 pts) Solve Exercise 15.2.
6. (10 pts) Solve Exercise 15.5.
7. (10 pts) Solve Exercise 15.22. Hint: Try modifying the example we used in class.

## References

- [AHV95] Serge Abiteboul, Richard Hull, and Victor Vianu. *Foundations of Databases*. Addison-Wesley, 1995.