

<http://u.arizona.edu/~mccann/classes/144>

## Homework #7

(50 points)

*Due Date: April 14<sup>th</sup>, 2023, at the beginning of class*

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### Directions

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1. **This is an INDIVIDUAL assignment; do your own work! Submitting answers created by computers or by other people is NOT doing your own work.**
2. Start early! Getting help is much easier  $n$  days before the due date/time than it will be  $n$  hours before.
3. Write complete answers to each of the following questions, in accordance with the given directions. Create your solutions as a PDF document such that each answer is clearly separated from neighboring answers, to help the TAs easily read them. Show your work, when appropriate, for possible partial credit.
4. The questions that have section numbers are found in the Rosen text, available via D2L. Note that “(w,z)” is asking you to complete parts w and z only, not parts x and y.
5. If you have questions about any aspect of this assignment, help is available from the class staff via [piazza.com](https://piazza.com) and our office hours.
6. When your answers are ready to be turned in, do so on [gradescope.com](https://gradescope.com). Be sure to assign pages to problems after you upload your PDF. Need help? Visit <https://help.gradescope.com/> and search for “Submitting an Assignment.”
7. **Solutions submitted more than five minutes late will cost you a late day. Submissions more than 24 hours late are worth no points.**

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#### Section 4.1: Divisibility and Modular Arithmetic:

1. (6 points) Section 4.1, 6. Also assume that  $b \neq 0$ . A complete proof is expected!
2. (2 points) Section 4.1, 14(e)
3. (2 points) Identify the four smallest positive integers greater than 100 that are congruent to 5 modulo 14.

#### Section 4.3: Primes and Greatest Common Divisors:

4. (2 points) Section 4.3, 4(c)
5. (4 points) Section 4.3, 16(a,c)
6. (4 points) Section 4.3, 24(a,f)
7. (4 points) Section 4.3, 26(a,f)
8. (2 points) Section 4.3, 30

(Continued ...)

Section 2.4: Sequences and Summations:

9. (4 points) Section 2.4, 4(b,d)
10. (4 points) Section 2.4, 26(a,c)

Section 2.5: Cardinality of Sets:

11. (4 points) Section 2.5, 2(b,e)

Prolog!:

**Background:** On Friday I covered my “Quick-’n’-Dirty Prolog Tutorial” in class, explained how to access our main instructional machine ([lectura.cs.arizona.edu](http://lectura.cs.arizona.edu)), and demonstrated how to run and use `gprolog`. There’s also a video that covers accessing `lectura`, creating a text file containing a prolog database, loading a Prolog database into `gprolog`, and running queries. You can find that video in D2L with the Homework 7 handout in the Content area.

The first thing you need to do is find the email you received when you started taking CS classes. It was sent from `it-admin@cs.arizona.edu` with the subject line of “Welcome of the Department of Computer Science”. It contains information about your CS account. If you can’t find that email, or changed your CS password at that time and forgot it, you can reset it by visiting <https://helpdesk.cs.arizona.edu> and clicking on the red link that reads “Click here to self manage your CS account/password.” When you have your account ready to go, have read the tutorial, and have watched that video, you should be ready for the following questions. Start early so that you can get help if you need it!

12. (6 points) This semester I’m teaching CSc 460 and Prof. Zhang is teaching CSc 445. My grad TAs in CSc 460 are Tanner and Aayush. But, Aayush is also a TA for CSc 445. A professor supervises a TA if the professor is teaching a class and a TA is TAing for the same class.

Create a Prolog database that contains two collections of facts and one rule, all based on the above description. The first set of facts has facts of the form `ta(taname,class)`, and the second set has facts of the form `instructor(profname,class)`. You’ll have three `ta` facts and two `instructor` facts. The rule is named `supervises`, and is to be constructed to follow the logic of the supervision description above.

When your database is created on `lectura`, load it into Prolog and use it to answer these two queries:

- `supervises(zhang,aayush)`. (In English: Does Zhang supervise Aayush?)
- `supervises(mccann,X)`. (Who are the TAs that McCann supervises?)

As your answer to this question in your PDF, include screenshots that show: (a) The facts and the rule in your database, and (b) the results `gprolog` produced when you ran the two queries.

13. (6 points) Question 2(b) on Exam 2 asked about this argument: ALL TYIPS HAVE POLTS. ALL GNULTS ARE TYIPS. VERT IS A GNULT. THEREFORE, VERT HAS POLTS. Create a Prolog database that confirms that this argument is valid. You’ll need one fact (stating that Vert is a gnult), and two rules (one for “all tyips have polts” and one for “all gnults are tyips”). When your database is complete, use it to answer the query `polts(X)`. (Who has polts?)

As your answer to this question in your PDF, include screenshots that show: (a) The fact and rules in your database, and (b) the result `gprolog` produced when you ran the query.