Homework #1
(95 points)

Due Date: September 28th, 2017, at the beginning of class

Name: ___________________________ NetID: ___________________________

Directions: Write complete, legible answers to each of the questions given on the second page. A problem identified as “M.N(x,y)” references parts x and y of exercise N from chapter M of the Connolly/Begg text, 6th edition. Show your work, when appropriate, for possible partial credit. This is not a group project; do your own work.

All homeworks in this class must be electronically submitted, and some require the creation of diagrams. You may use a diagramming tool for this purpose; several open-source and/or free options exist (xfig, dia, LibreOffice, etc.). You may also draw your diagrams by hand and scan/photograph them for inclusion within your solutions document, so long as the result is readable and reasonably sized.

On or before the due date, by the start of class, hand-in a printout of your solutions with this cover page stapled to the front and submit your electronically-formatted (as a PDF, please) version of your solutions (the turnin folder is cs460h1). Solutions submitted more than 24 hours after the due date and time will not be accepted.

— Points —

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Score: ___________________________

(Questions are on the back . . .)
1. (5 points) 1.4
2. (5 points) 2.2
3. (5 points) 3.2
4. (5 points) 3.18(a), but use the MySQL DBMS (www.mysql.com) as your subject
5. (5 points) 4.2
6. (5 points) 4.5
7. (5 points) 12.2 (skip quaternary, and use examples not used in class or found in the text)
8. (5 points) 12.7 (find an example not used in class or found in the text)
9. (20 points) 12.12 (all parts)
10. (5 points) 13.10
11. (10 points) You have a RAID 0 system of four hard drives. Two of the drives have a failure rate of 1.5% \( (p_f = 0.015) \), and the other two have a failure rate of 3%. Assume that failures of the hard drives are independent events.
   (a) What is the probability of failure of your RAID system?
   (b) Assuming that your quantities of 1.5% and 3% drives remain equal (that is, you have \( n \) 1.5% and \( n \) 3% drives), what is the minimum total number of hard drives your RAID system would have to have to exceed a 50% failure rate?
12. (10 points) In Program #2, you extendibly-hashed using decimal digits of a key. For this exercise, assume that our keys are in Base 3 instead of Base 10. Also assume that buckets are disk blocks that can hold at most three keys each. Build a dynamic hashing (not extendible hashing!) index structure using the keys listed below, and draw the final structure.

   \begin{itemize}
   \item 1112,
   \item 2210,
   \item 0001,
   \item 0111,
   \item 1221,
   \item 0120,
   \item 1210,
   \item 2100,
   \item 1102,
   \item 0122,
   \item 0012,
   \item 2112
   \end{itemize}

13. (10 points) Assuming a B\(^{+}\)-tree of Order 2 (using the order concept of Comer’s definition).
   (a) Insert the values \( J, A, F, C, R, S, \) and \( L \), in the order presented. Show the tree after each insertion that causes the tree to grow by a level, and show the final tree.
   (b) Delete, from your final tree of part (a), the following keys, and show the final tree: \( L \) and \( F \) (in that order). Again, you may show intermediate trees if you so desire.