***Homework 3-1***

1. (50 points) Derive the I/O costs of different join algorithms of relations R and S given the following variables, which you may or may not use all of them. Suppose that there is 1 page of results for the join. Ignore the CPU time cost. Please write down steps to explain your answer for full credits.

|R|=20: Number of tuples per page in R

|S|=20: Number of tuples per page in S

M=120: Number of pages in R

N=40: Number of pages in S

B=10: Number of available main memory in pages

* 1. (10 points) What is the minimal I/O cost of block nested loop join?
  2. (10 points) What is the minimal I/O cost of simple nested loop join?
  3. (10 points) What is the minimal I/O cost of indexed nested Loops Join​? (Suppose the cost of retrieving a matching tuple is 3, for both R and S)
  4. (10 points) What is the minimal I/O cost of grace hash join?
  5. (10 points) What is the minimal I/O cost of Sort-Merge Join​? (Suppose the join is on their primary keys which are sorted already)

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**Submission Instruction**

*Please use Microsoft Words or other tools to type your answer. Don't handwrite. Submit your work in pdf through your Canvas account.*