Database Management Systems, Aug–Dec 2025

Assignment 4, 21 November 2025, due 30 November 2025

1. We wish to sort a table that occupies 100 blocks on disk. Assume that the memory can hold 10 blocks.

   (a) How many sorted runs are created in the first run? What is the size of each sorted run?

   (b) After the first run, how many merge iterations are needed to sort the table fully? What are the sizes of the sorted runs after each merge pass?

   (c) Compute the same quantities assuming that the table had 200 blocks and that the memory could hold 15 blocks.

2. Let relations $r_1(A, B, C)$ and $r_2(C, D, E)$ have the following properties: r_1 has 6×10^5 tuples, r_2 has 2×10^5 tuples, 40 tuples of r_1 fit in one block, and 25 tuples of r_2 fit in one block. Neither r_1 nor r_2 is sorted with respect to any of its attributes.

   (a) Estimate the number of block seeks and block accesses required to compute $r_1 \bowtie r_2$ using nested-loop join. Explain your answer, including your choice of outer and inner relations.

   (b) Estimate the number of block seeks and block accesses required to compute $r_1 \bowtie r_2$ using block nested-loop join in the following situations. Explain your answers, including your choice of outer and inner relations.

      (i) The memory can hold approximately 1000 blocks.

      (ii) The memory can hold approximately 10000 blocks.

3. Consider the following concurrent schedules for the same pair of transactions T_1 and T_2.

Schedule A

T_1	T_2
	`read(X)`
	`v = 0.05*X`
	`X = X - v`
	`write(X)`
`read(X)`	
`X = X + 500`	
`write(X)`	
`read(Y)`	
`Y = Y - 500`	
`write(Y)`	
	`read(Y)`
	`Y = Y + v`
	`write(Y)`

Schedule B

T_1	T_2
	`read(X)`
	`v = 0.05*X`
	`X = X - v`
`read(X)`	
`X = X + 500`	
`write(X)`	
	`write(X)`
	`read(Y)`
	`Y = Y + v`
	`write(Y)`
`read(Y)`	
`Y = Y - 500`	
`write(Y)`	

Schedule C

T_1	T_2
`read(X)`	
`X = X + 500`	
`write(X)`	
	`read(X)`
	`v = 0.05*X`
	`X = X - v`
	`write(X)`
`read(Y)`	
`Y = Y - 500`	
`write(Y)`	
	`read(Y)`
	`Y = Y + v`
	`write(Y)`

   (a) Which ones are serializable? Justify your answers.

   (b) Which ones are conflict serializable? Justify your answers.