CS386D Database Systems
HW5b Solutions

Part A

15.3.2

B(R) = B(S) = 10,000, and M = 1000.

I/O cost = $B(S) + \lceil B(S)/M - 1 \rceil B(R) = 100000 + \lceil 100000/999 \rceil 100000 = 120000$

15.3.3a

B(R) = B(S) = 10,000, I/O cost <= 100,000

$B(S) + \lceil B(S)/M - 1 \rceil B(R) <= 100,000$

$\Rightarrow 10000 + \lceil 10000/M - 1 \rceil 10000 <= 100,000$

$\Rightarrow \lceil 10000/M - 1 \rceil <= 9$

$\Rightarrow \lceil 10000/9 \rceil <= M - 1$

$\Rightarrow M >= 1113\ blocks$

16.2.6 a

π_L(R(a,b,c) ⋈ S(b,c,d,e))

L = b+c→x,c+d→y

Pushing projection below join: $\pi_{b+c \to x,c+d \to y}(\pi_{b,c}(R(a,b,c)) \bowtie \pi_{b,c,d}(S(b,c,d,e)))$

This is equivalent to: $\pi_{b+c \to x,y}(\pi_{b,c}$ R(a,b,c) ⋈ $\pi_{b,c,c+d \to y}$ S(b,c,d,e))

16.2.6 b

π_L(R(a,b,c) ⋈ S(b,c,d,e))

L = a,b,a+d→z

Pushing projection below join: $\pi_{a,\ b,\ a+d \to z}$ ($\pi_{a,\ b,\ c}$R(a,b,c) ⋈ $\pi_{b,\ c,\ d}$S(b,c,d,e))

Part B

1. B(R) x c = 1000c , where c is cost of reading a block.

2. Let c be the cost of reading the first block and c' be the cost of reading the next adjacent block. Then the cost is c+c'(B(R) - 1) = c' + 999c'

3.

a. Ignoring 'primary key'. $\frac{B(W)}{V(W,c)} = 10 \; or \; 10c$

b. $\frac{T(W)}{V(W,c)} = 1000$

4.

a. (c,b,a) is a compound primary key and the query has constraints on values in (c,b,a). So 1 block.

b. $\frac{T(R)}{V(R,a)\,V(R,b)\,V(R,c)} = 1$

5.

a. Let them be clustered according to the primary key (c,b,a) on disk, then the estimated cost is, then the estimated cost is B(R) / T(R) * (no. of records) = 1. Otherwise, it's 100.

b. $\frac{T(R)}{V(R,b)\,V(R,c)} = 100$

6.

a. $\frac{T(W)}{V(W,b)\,V(W,c)} = 50$

b. $\frac{T(W)}{V(W,b)} + \frac{T(W)}{V(W,c)} + \frac{T(W)}{V(W,b)\,V(W,c)} = 1450$

7.

a. $\frac{T(W)}{3\,V(W,c)} = 10000 / (3 * 10) \approx 333$

b. $T(W)\,(1 - (1 - 1/3)(1 - \frac{1}{V(W,c)}\,)\,) \approx 4000$

8. No common attribute, so 0. If assumed full join instead, then T(S) x T(U) = 10000000.

9. $\frac{T(W)\,T(V)}{max(\,V(V,c), V(W,c)\,)} = 10,000$

10. $\frac{T(R)\,T(W)}{max(\,V(R,b),\,V(W,b)\,) * max(\,V(R,c),\,V(W,c)\,)} = 1,000,000$

11. $T(\sigma_{c>50}R) = T(R) / 3$

$\frac{T(R)\,T(U)}{3 * max(\,V(R,b),\,V(U,b)\,)} \approx 8,333,333$

12. $\frac{T(R)\,T(W)}{3 * max(\,V(R,c),\,V(W,c)\,)} \approx 66,666,667$