14.4.

- Relation R contains 10K tuples & 10 tuples per page.
- Relation S " 2K tuples & 10 tuples per page
- Att. b is a primary key for S
- No index & heap file storage for both R & S
- 52 buffer pages.

---

1) cost of $R \underset{R.a=S.b}{\bowtie} S$ using page-oriented simple nested loop join?

Total cost = $N + (N \times M)$

N ↓ outer page size

M ↳ inner page size

$= 200 + (200 \times 1000)$

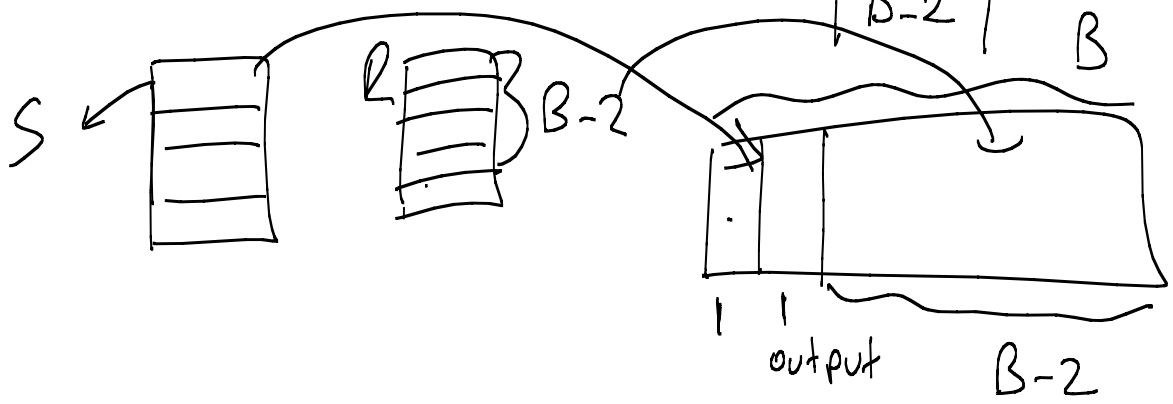
$= 200,200$

---

2) cost of $R \underset{R.a=S.b}{\bowtie} S$ using block nested loop join?

R a S b

Total cost = $N + M \times \left\lceil \frac{N}{B-2} \right\rceil$



$= 200 + 1000 \times \left\lceil \frac{200}{50} \right\rceil$

$= 4200$

Assume B is 50

Total cost $= 200 + 1000 \times \underbrace{\left\lceil \frac{200}{48} \right\rceil}_{5}$

$= 5200$

Assum B is 51

Total cost $= 200 + 1000 \times \left\lceil \frac{200}{49} \right\rceil$

$= 5200$

---

5) what would be the lowest possible I/O cost for joining R and S using any algorithm and how much buffer space would be needed to achieve this cost?

Idea 1: Read everything into memory & do in-memory join

$$TC = M + N$$

$$\text{Buffer page} = M + N + 1$$

Idea 2: Read the smallest relation to memory and do block nested loop join

$N = \min(N, M)$

$$TC = N + M \cdot \left\lceil \frac{N}{B-2} \right\rceil$$

$\rightarrow B = N + 2$

$$= N + M$$

17.2.10)

T2: R(X), T3: W(X), T3: C, T1: W(Y), T1: C, T2: R(Y),

↳ T2: W(Z), T2: C

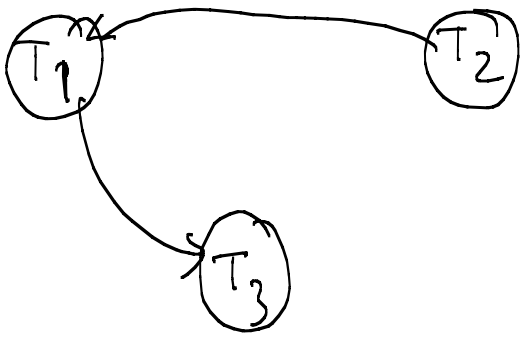
T_1

Conflict - serializable
View - "
"

17.4.2

T1: R(X), T2: W(X), T2: W(Y), T3: W(Y), T1: W(Y), T1: C, T2: C
T3: C

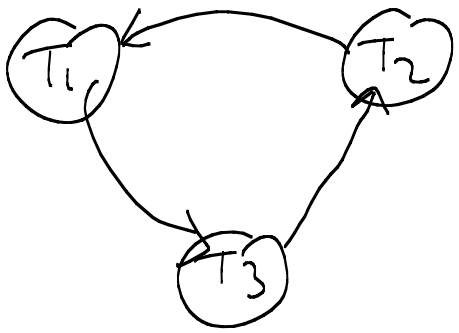
- S2PL with deadlock detection
- Draw the waits-for-graph.



X → T1 has S lock
& T2 is waiting on X

Y → T3 has X lock

S2: T1: R(X), T2: W(Y), T2: W(X), T3: W(Y), T1: W(Y), T1: C
T2: C
T3: C



X → T1 → S lock → T2 waits on X

Y → T2 → X lock

T3 → T1

19-2. R(A, B, C, D, E) FD = {A → B, BC → E, ED → A}

1) $\{A\}^+ = \{A, B\}$, $\{B\}^+ = B$, $C^+ = \{C\}$, $\{D\}^+ = D$

$\{CD\}^+ = \{CD\}$

$\{ACD\}^+ = \{ABCDE\}$

$\{BCD\}^+ = \{ABCDE\}$

$\{ECD\}^+ = \{ABCDE\}$

since $\{B, E, A\} \subseteq$ some candidate key

R is in 3NF.

R is not BCNF

chap 19.7.5

R(A B C D), F = { AB → C, AB → D, C → A, D → B }

a) $\{D\}^+ = \{DB\}$, $C^+ = \{CA\}$

$\{B\}^+ = B$, $A^+ = \{A\}$

$\{AB\}^+ = \{ABCD\}$ → Key

$\{BC\}^+ = \{ABCD\}$

$\{CD\}^+ = \{ABCD\}$

$\{AD\}^+ = \{ABCD\}$

b) R is 3NF & R is not in BCNF

ACD DB

CD, CA

{C → A} {B → D}

BDC, CA

BD DC