

Answers of Problem 1:

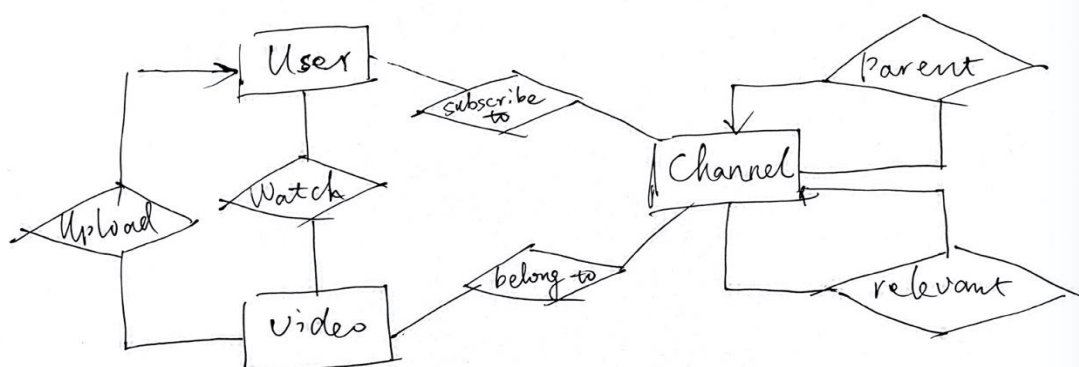
- (1) $\Pi_{pname}(\text{project} \bowtie (\sigma_{cname="X Bank"}(\text{client})))$
- (2) Create table participate (
 eId char(12),
 pId char(12),
 role char(24),
 primary key (eId,pId),
 foreign key (eId) references employee,
 foreign key (pId) references project,
 check role in ("project manager", "developer", "tester"))
- (3) select eName from employee where eId in (select eId from participate group by eId having count(distinct role) = 3)
- (4) select eName from employee natural join participate where pId = "p1102" and eSalary in (select max(salary) from employee natural join participate where pId = "p1102")

or

with pemmployee(eId, eName, salary) as (select eId,eName, salary from employee where eId in (select eId from participate where pId = "p1102"))
select eName from pemmployee where salary in (select max(salary) from pemmployee)

- (5) participate (eId, pId, roleId)
 role (roleId, roleName)

Answers of Problem 2:



Answers of Problem 3:

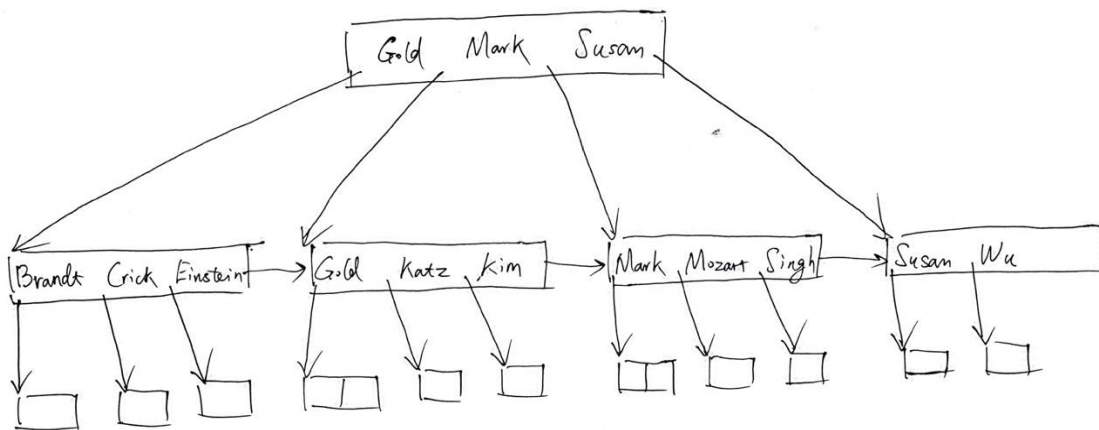
- (1) ABI
- (2) $F_c = \{B \rightarrow CH, AC \rightarrow D\}$
- (3) (ACD, BCH, ABI) : dependency preserving; or (BCH, ABD, ABI): not dependency preserving

Answers of Problem 4:

- (1) /client[cname = "X Bank"]/project[paid>50000]/pname
- (2) /employee[ename="John"]/participate[role = "project manager"]/id(@pid)/pname
- (3) for \$x in /employee[ename="John"]/participate,
 \$y in /client[ccity="shanghai"]/project
 where \$x/@pid = \$y/@pid
 return {\$y/pname}

Answers of Problem 5:

- (1)



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- (2) max entries per node : $\lfloor (4096-4)/(32+4) \rfloor = 113$, $n = 114$; B+-tree max height = $\lfloor \log_{57} 9000 + 1 \rfloor = 3$; worst case blocks to read: $3(\text{B+-tree blocks}) + 1(\text{bucket block}) + 5(\text{one block for each employee}) = 9$

Answers of Problem 6:

- (1) a. Shanghai client number: $500/100 = 5$
b. estimated size = $5 * 40000 / V(cId, project) = 500$
(2) blocks of employee: $30000/40 = 750$; blocks of participate: $40000/100 = 400$
(3) most optimistic: $M = 50$, $n = 400/50 = 8$, $b_b = \lfloor 50 / (8+1) \rfloor = \lfloor 50/9 \rfloor = 5$
Transfers: $3(b_r + b_s) + 4n = 3*(1150) + 32 = 3450 + 32$
Seeks: $2(\lceil b_r / b_b \rceil + \lceil b_s / b_b \rceil) + 2n = 2*(\lceil 750/5 \rceil + \lceil 400/5 \rceil) + 16 = 460 + 16$

or

considering fudge factor = 1.2:

$$M = 50, n = \lceil 8 * 1.2 \rceil = 10, b_b = \lfloor 50 / (10+1) \rfloor = \lfloor 50/11 \rfloor = 4$$

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Answers of Problem 7:

- (1) normal: 250000; 250000+800; 250000+1500; 250000+2300; extra: 250000+1000 (there is no "190012"); 250000+500; 250000+1300 (there is no "181020").
(2) Yes. T1 read "181020"; T3 write "190012"; T1 read "190012"; T3 write "181020"
(3) No

Answers of Problem 8:

- (1) t1: write <checkpoint LTransactions> to log buffer; output log buffer to log file;
t3: output log buffer to log file; output B1 to disk;
t7: do nothing for log or data. (save pointer of <checkpoint L> to a save place)
(2) t2: write a data modification log to log buffer; modify B1; do nothing to others
(3) redo: T2, T4; undo: T3
(4) redo start: t1; undo end: beginning of T3