561 hw4

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1 Q1

let $Dup = \pi_A(\sigma_{A_1=A_2 \wedge B_1 \neq B_2}(W_1 \times W_2))$

$Dup \cup (\pi_A(W) - \pi_A(\sigma_{Dup.A \neq W.A}(Dup \times W)))$

2 Q2

2.1 (a) (10 points) Find the sid and sname of each student who bought a book that cites another book.

$\pi_{Sid,Sname}(\sigma_{Student.Sid=Buys.Sid \wedge Buys.BookNo=Cites.BookNo}(Student \times Buys \times Cites))$

or

$\pi_{Sid,Sname}(Student \bowtie Buys \bowtie Cites)$

2.2 (b) (10 points) Find the sid and sname of each student who has at least two majors.

$\pi_{SMaj.Sid,SMaj.Sname}(\sigma_{SMaj.Sid=Major2.Sid \wedge SMaj.Major \neq SMaj.Major}((Major1 \bowtie Student)$as SMajr $\times Major2))$

2.3 (c) (10 points) Find the sid of each student who bought exactly one book.

$\pi_{Sid}(Buys) - \pi_{Sid}(\sigma_{Buys1.Sid=Buys2.Sid \wedge Buys1.BookNo \neq Buys2.BookNo}(Buys1 \times Buys2))$

2.4 (d) (10 points) Find the bookno and title of each book with the second to lowest price.

let $CheapestBookPrice = \pi_{Price}(Book) - \pi_{Book2.Price}(\sigma_{Book1.Price<Book2.Price}(Book1 \times Book2))$

$\pi_{BookNo}(\sigma_{Book.Price>CheapestBookPrice}Book) -$

$\pi_{Book2.BookNo}(\sigma_{Book1.Price<Book2.Price \wedge Book1.price \neq CheapestBookPrice}(Book1 \times Book2))$

2.5 (e) (10 points) Find the bookno and title of each book that was only bought by the student with sid = 1001.

$\pi_{BookNo,title}(Book) - \pi_{BookNo,title}(\sigma_{Sid \neq 1001}(Buys \bowtie Books))$

2.6 (f) (10 points) Find the sid and sname of each student who bought at least two books that cost less than \$50.

let = BoughtPrice = $\sigma_{Sid,BookNo,Price}(Buys \bowtie Book)$

$\pi_{Sid,Sname}(\sigma_{B1.Sid=B2.Sid \wedge B1.BookNo \neq B2.BookNo \wedge B1.price<50 \wedge B2.price<50 \wedge B1.Sid=Sid}$
$(BoughtPrice$ as B1 $\times BoughtPrice$ as B2 $\times Student))$

2.7 (g) (10 points) Find the bookno of each book that was not bought by all students who major in CS.

let CSMajorStudent = $\pi_{Sid}(\sigma_{Major.Major='CS'}(Major))$

$\pi_{BookNo}(CSMajorStudent \times Book - Buys)$

2.8 (h) (10 points) Find the bookno of each book that is not cited by a book that cost more than \$50.

$\pi_{BookNo}(Book) - \pi_{CitedBookNo}(Cites \bowtie_{Cites.Cite=Book.BookNo}(\sigma_{Book.Price>50}(Book)))$

2.9 (i) (10 points) Find the sid of each student who not only bought books that cost less than \$30.

$BookCostLessThan30 = \pi_{BookNo}(\sigma_{Price<30}Book)$

$\pi_{Sid}(Buys - \pi_{Sid,BookNo}(BookCostLessThan30 \times Student))$

2.10 (j) (10 point) Find each pair (s; b) such that s is the sid of a student who bought a book that does not cite the book with bookno b.

$\pi_{Sid,c}(\pi_{Sid,Buys.BookNo,(Book.BookNo}$ as c $_)(Buys \times Book) -$
$\pi_{Sid,Buys.BookNo,(Cite.CitedBookNo}$ as c $_)(Buys \bowtie_{Buys.BookNo=Cite.Cite} Cites)$

2.11 (k) (10 points) Find the pair of different booknos (b1; b2) that where bought by the same CS students.

$\pi_{B1.BookNo,B2.BookNo}(Book \times Book) -$
$($
$(\pi_{b.sid,B1.BookNo}$ as bno1$_{,B2.BookNo}$ as bno2$(\sigma_{Buys.Sid=Major.Sid \wedge Major.Major='CS'}$

$_{\wedge B.BookNo=B1.BookNo}(Buys \times Major \times Book$ as B1 $\times Book$ as B2)))

$- (\pi_{b.sid,B1.BookNo}$ as bno1$_{,B2.BookNo}$ as bno2$(\sigma_{Buys.Sid=Major.Sid\wedge Major.Major='CS'}$

$_{\wedge B.BookNo=B2.BookNo}(Buys \times Major \times Book$ as B1 $\times Book$ as B2)))

)

$\cup$

$\pi_{B1.BookNo,B2.BookNo}(Book \times Book) -$

(

$(\pi_{b.sid,B1.BookNo}$ as bno1$_{,B2.BookNo}$ as bno2$(\sigma_{Buys.Sid=Major.Sid\wedge Major.Major='CS'}$

$_{\wedge B.BookNo=B2.BookNo}(Buys \times Major \times Book$ as B1 $\times Book$ as B2)))

$- (\pi_{b.sid,B1.BookNo}$ as bno1$_{,B2.BookNo}$ as bno2$(\sigma_{Buys.Sid=Major.Sid\wedge Major.Major='CS'}$

$_{\wedge B.BookNo=B1.BookNo}(Buys \times Major \times Book$ as B1 $\times Book$ as B2)))

)

2.12 (l) (10 points) Find the pairs of dierent sid (s1,s2) of students such that all books bought by student s1 were also bought by student s2.

$\pi_{Sid1,Sid2}(\pi_{S1.Sid}$ as Sid1$_{,s2.Sid}$ as Sid2$(Student$ as S1, $Student$ as s2)

$-$

$\pi_{Sid1,Sid2}($

$\pi_{S1.Sid}$ as Sid1$_{,s2.Sid}$ as Sid2$(\sigma_{B.Sid=S1.Sid}(Buys$ as B, $Student$ as S1, $Student$ as s2)

$-$

$\pi_{S1.Sid}$ as Sid1$_{,s2.Sid}$ as Sid2$(\sigma_{B.Sid=S2.Sid}(Buys$ as B, $Student$ as S1, $Student$ as s2))

)

2.13 (m) (10 points) Find the bookno of each book that is cited by all but one book.

let notCite $= \pi_{c1.BookNo,c2.BookNo}$ as $_{notCited}(Cites \times Cites) - Cited$

$\pi_{bookno}(notCite)$

$-$

$\pi_{notCited}(\sigma(nc1.bookno \neq nc2.bookno \wedge nc1.notCited = nc2.notCited)(notCite \times notCite))$

3 Q3

3.1 (a) Find the sid and major of each student who bought a book that cost less than \$20.

$\pi_{Sid,Major}(\sigma_{t.bookno=b.booknoandb.price<20andm.sid=t.sid}(major$ as m , $buys$ as t , $book$ as b))

3.2 (b) Find each (s; b) pair where s is the sid of a student and where b is the bookno of a book whose price is the cheapest among the books bought by that student.

$\pi_{Sid,Bookno}(\sigma_{t.bookno=b.bookno}(buys \text{ as t}, book \text{ as b})) -$

$\pi_{Sid,Bookno}(\sigma_{t.bookno=b.bookno \wedge t1.bookno=b1.bookno \wedge t.Sid=t1.Sid \wedge notb.price>b1.price}$
$(buys \text{ as t}, book \text{ as b }, buys \text{ as t1}, book \text{ as b1}))$

3.3 (c) Find the bookno and title of each book that cost between \$20 and \$40 and that is cited by another book.

$\pi_{sid,sname}(\sigma_{20<=b.price \wedge b.price<=40 \wedge c.citedbookno=b.bookno}(book \text{ as b}, cites \text{ as c}))$

3.4 (d) Find the sid and name of each student who majors in 'CS' and who bought a book that is cited by a lower priced book.

$\pi sid, sname(\sigma_{s.sid=m.sid \wedge m.major='CS' \wedge s.sid=t.sid \wedge t.bookno=c.citedbookno \wedge c.citedbookno=b1.bookno}$

$_{\wedge c.bookno=b2.bookno \wedge b1.price>b2.price)}$
$(student \text{ as s }, major \text{ as m }, buys \text{ as t }, cites \text{ as c }, book \text{ as b1 }, book \text{ as b2}))$

3.5 (e) Find the bookno and title of each book that is not bought by all students who major in 'CS'.

$\pi_{bookno,title}(\sigma_{m.major='CS'}(major \text{ as m}, Book \times \text{ as b}) -$
$\sigma_{m.major='CS' \wedge m.sid=t.sid \wedge t.bookno=b.bookno}(major \text{ as m} \times Book \text{ as b} \times Buus \text{ as t}))$

3.6 (f) Find the bookno and title of each book that is bought by all students who major in both 'CS' and in 'Math'.

$\pi_{bookno,title}(\pi_{bookno,title}(book)$
$-$
$\pi_{bookno,title}($
$\pi_{bookno,title}(\pi_{s.sid,b.Bookno,b.title}(\sigma_{s.sid=m.sid \wedge m.major='CS' \wedge s.sid=m2.sid \wedge m2.major='Math'}$
$(student \text{ as s} \times major \text{ as m} \times major \text{ as m2} \times book \text{ as b}))$
$-$
$(\pi_{s.sid,b.Bookno,b.title}(\sigma_{s.sid=m.sid \wedge m.major='CS' \wedge s.sid=m2.sid \wedge m2.major='Math' \wedge s.sid=t.sid \wedge t.bookno=b.bookno}$
$(student \text{ as s} \times major \text{ as m} \times major \text{ as m2} \times book \text{ as b} \times buys \text{ as t}))))$
$)$