

Q1:

1. get the name and age of the student who stayed over 2 years from the Students table
2. get the course size which grid is 3 from Courses table.
3. get the name of the student whose gpa is over 3 and major in Art History from the Students table.
4. get the classroom size and classroom id. if the course is under art history department
5. get all the students' name if their major is same as the course department and the course they are in has less than 100 people
6. get the course id if its classroom is not in Mudd

Q2: (1)

PName	Price	Discount	Category	Manufacturer
Gizmo.	\$19.99	\$16.99	Gadgets	Gworks
Power Gizmo.	\$29.99	\$25.99	Gadgets	Gworks.

ii

prodName	store.
Gizmo	wiz
PowerGizmo	Ritz.
Camera.	wiz

iii

P Name	Price	Discount	Category	Manufacturer
Gizmo.	\$19.99	\$16.99	Gadgets	Gworks
Power Gizmo	\$29.99	\$25.99	Gadgets	Gworks.
Single Touch	\$149.99	\$144.99	photograph	Canon
Multi Touch	\$203.99	\$199.99	Household	Hitachi

iv.

Discount - Price
\$1 - 7.00.

v.

P Name	Price	Discount	Category	Manufacturer	prodName	Store
Gizmo.	\$19.99	\$16.99	Gadgets	Gworks	Gizmo.	wiz.
Power Gizmo	\$29.99	\$25.99	Gadgets	Gworks.	PowerGizmo	Ritz

Vi

ProdName	Stone	PName	Price	Discount	Category	Manufacturer
Gizmo	Wiz.	Gizmo.	\$19.99	\$16.99	Gadgets	Gworks
Power Gizmo	Ritz	Power Gizmo	\$29.99	\$25.99	Gadgets	Gworks.

Vii

ProdName	Stone	PName	Price	Discount	Category	Manufacturer
Gizmo	Wiz.	Gizmo.	\$19.99	\$16.99	Gadgets	Gworks
Power Gizmo	Ritz	Power Gizmo	\$29.99	\$25.99	Gadgets	Gworks.
Camera	Wiz	null	null	null	null	null.

Q3. 1. $A \cup B = \{2, 1, 3, 4\}$

2. $B \cup A = \{3, 1; 4, 2\}$

3. $D \cup C = \{2; 1, 3, 1, X, Y\}$

Q4.

(1)

pid	PName	Price	DiscountPrc	Category	Manufacturer	pid	PName	Price	DiscountPrc	Category	Manufacturer
18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks	18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks
70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks	70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks
32	SingleTouch	\$149.99	\$144.99	Photograph	Canon	32	SingleTouch	\$149.99	\$144.99	Photograph	Canon
67	MultiTouch	\$203.99	\$199.99	Household	Hitachi	67	MultiTouch	\$203.99	\$199.99	Household	Hitachi

(2)

pid	PName	Price	DiscountPrc	Category	Manufacturer	pid	PName	Price	DiscountPrc	Category	Manufacturer
18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks	18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks
70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks	70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks
32	SingleTouch	\$149.99	\$144.99	Photograph	Canon	32	SingleTouch	\$149.99	\$144.99	Photograph	Canon
67	MultiTouch	\$203.99	\$199.99	Household	Hitachi	67	MultiTouch	\$203.99	\$199.99	Household	Hitachi

(3)

pid	PName	Price	DiscountPrc	Category	Manufacturer	pid	PName	Price	DiscountPrc	Category	Manufacturer
18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks	18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks
70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks	70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks
32	SingleTouch	\$149.99	\$144.99	Photograph	Canon	32	SingleTouch	\$149.99	\$144.99	Photograph	Canon
67	MultiTouch	\$203.99	\$199.99	Household	Hitachi	67	MultiTouch	\$203.99	\$199.99	Household	Hitachi

(4)

pid	PName	Price	DiscountPr	Category	Manufacturer	pid	PName	Price	DiscountPr	Category	Manufacturer
18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks	null	null	null	null	null	null
70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks	null	null	null	null	null	null

(5)

pid	PName	Price	DiscountPr	Category	Manufacturer	pid	PName	Price	DiscountPr	Category	Manufacturer
null	null	null	null	null	null	32	SingleTouch	\$149.99	\$144.99	Photograph	Canon
null	null	null	null	null	null	67	MultiTouch	\$203.99	\$199.99	Household	Hitachi

(6)

pid	PName	Price	DiscountPr	Category	Manufacturer	pid	PName	Price	DiscountPr	Category	Manufacturer
18	Gizmo	\$19.99	\$16.99	Gadgets	GWorks	null	null	null	null	null	null
70	PowerGizmo	\$29.99	\$25.99	Gadgets	GWorks	null	null	null	null	null	null
null	null	null	null	null	null	32	SingleTouch	\$149.99	\$144.99	Photograph	Canon
null	null	null	null	null	null	67	MultiTouch	\$203.99	\$199.99	Household	Hitachi

	minimum	maximum
Q5. i. R ∪ S where U is union.	n	n+m
R intersect S	0	m
R inner join S	0	mn
S full outer join S	m	m^2
R-S	n-m	n.
S-R	0	m

Q6. i. durability (five written, writes disappeared)	ii. atomicity (1b-byte or nothing)	iii. consistency (account balance lower than minimum)	iv. isolation (effect of transaction not the same as run one after another)
v. consistency (1000 credit instead of 1000)	vi. atomicity we have two files instead of 1.	vii. durability (can not retrieve)	viii. isolation (effect of transaction not the same as run one after another)

Q7.

$$1. \frac{40}{30} = 1.33 \text{ job/sec}, \quad \frac{40}{35} = 1.142 \text{ job/sec}.$$

2. A system is better by 0.16375

3. $\frac{35}{25} = 1.4$. Speed up

4. B. $- \frac{30}{40} = 0.75$

Q8.

$$1. \sqrt{0.5 + 0.5/(10/9)} = 1.052. \quad 3. \sqrt{(0.85 + 0.15/10)} = 1.156$$

2. $\sqrt{(0.95 + 0.05/10)} = 1.047 \quad 4. \text{the third one}$

$$Q9. \quad 1. \quad 0.8 \times 5 + 0.2 \times 25 = 9 \text{ ns}$$

$$2. \quad 0.95 \times 5 + 0.05 \times 10^6 = 50004.75 \text{ ns}$$

$$3. \quad 0.85 \times 25 + 0.15 \times 10^6 = 150021.3 \text{ ns}$$

Q10.

$$1. \quad 1 \text{ min} / 100000 = 60 / 100000 = 6 \text{ ms.}$$

$$2. \quad 4 / 1000000 \text{ (100 MB)} = 0.039 \text{ ms.}$$

$$3. \quad 4 + 0.5 \times 6 \text{ ms} + 0.039 \text{ ms} = 4 + 0.5 \times 6 = 7.039 \text{ ms.}$$

$$\text{rate of I/O} = 4 \text{ KB} / 7.039 = 0.555 \text{ MB/S.}$$

4.

$$\text{time taken: } 4 + 0.5 \times 6 \text{ ms} + 125 \text{ MB} / (100 \text{ MB/S}) = 125.7 \text{ ms}$$

$$\text{rate of I/O: } 125 \text{ MB} / 125.7 \text{ ms} = 99.443 \text{ MB/S.}$$

$$Q11(i) \quad 6000 / (10 * 10 + 16 * 200) = 1.8181$$

$$(ii) \quad 6000 / (4 * 10 + 18 * 200) = 1.563.$$

$$(iii) \quad 6000 / 21 * 200 = 1.428$$

12.

1.

Name	Title	Salary
A	Professor	99
B	Professor	103
C	Staff	62
D	Staff	58
E	Student	17.5
F	Student	17.5

2.

Name	Title	Salary
A	Professor	99
B	Professor	103
C	Staff	62
D	Staff	58
E	Student	35
F	Student	35

3.

Name	Title	Salary
A	Professor	99
B	Professor	103
C	Staff	62
D	Staff	58
E	Student	35
F	Student	35

13. ① read-read conflict ② no conflict

a. ③ write-read conflict ④ write-write conflict.

b. ① T₁ request a share lock on A . T₂ request a share lock on A
T₂ request an exclusive lock on A which fails because
it needs to wait T₁ release lock

③ T₁ request sharelock on A to read. then request an exclusive lock on A to write. T₂ request a sharelock on A to read. but T₁ hasn't release the lock.

④ T₁ request an exclusive sharelock on A to write, it also request C to write. T₂ request exclusive lock on A to write. however. T₁ lock hasn't unlock.

Q₁₄

1. T₁ read on X → T₂ read on X → T₂ write on X → T₁ write on X.
T₁ read on Y → T₁ write on Y → T₂ read on Y → T₂ write on Y → Commit T₁ → Commit T₂

T₁ reads X so it has a sharelock on X however T₂ started write on X so there is a conflict thus not serializable.
(a read-write conflict)

2. T₁ has a sharelock on X and T₂ also ask for sharelock. then T₂ ask for exclusive lock which strive 2PL disallow. it's dead lock since T₂ also have a sharelock on X thus even if T₁ try to get exclusive lock it will be blocked too.

3. When deadlock, DBMS will abort one transaction ^(temporary)
let one transaction commit then release the lock.

Q15. It should work if T is split into 2 lets say
 T_1 only access to X and T_2 access to Y. and if
S access to X only, Then all transaction
schedule should be serializable.

Q16 ^{database replica}
Reading transaction will lock the nearest writing transaction.
will lock lock every database replica

Yes it will lead to deadlock. and it can be
avoid by putting a lock while writing for all
database replica. All writing transaction should
follow a fix order to lock and update all the
database replica.