CS 5530

Database Systems
Spring 2020

Adv. Queries III

Midterm Info

CASE

- Conditional select

```
select
case
   when Grade = 'A' then 'Superior'
   when Grade = 'B' then 'Good'
   when Grade = 'C' then 'Adequate'
   else 'Poor'
end
from Submissions;
```

- Returns a column containing “Superior”, “Good”, or “Adequate” values

CASE

- Column name will be entire “case .. end” statement

```
select
case
   when Grade = 'A' then 'Superior'
   when Grade = 'B' then 'Good'
   when Grade = 'C' then 'Adequate'
   else 'Poor'
end as Remarks
from Submissions;
```

- Usually want to rename it

Exercise

- List all students as:
  - Freshman (18 y.o.)
  - Sophomore (19 y.o.)
  - Junior (20 y.o.)
  - Senior (21 y.o.)

Ponder

- Suppose we want to return all of Joe's books

Library

Patrons

Name	CardNum
Joe	1
Ann	2
Ben	3
Dan	4

Inventory

Serial	ISBN
1001	978-0590353427
1002	978-0590353427
1003	978-0679732242
1004	978-0394823379
1005	978-0394823379
1006	978-0062278791

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

Phones

CardNum	Phone
1	555-5555
2	666-6666
3	777-7777
4	888-8888
4	999-9999

Titles

ISBN	Title	Author
978-0590353427	Harry Potter	Rowling
978-0679732242	The Sound and the Fury	Faulkner
978-0394823379	The Lorax	Seuss
978-0062278791	Profiles in Courage	Kennedy
978-0441172719	Dune	Herbert

Ponder

- Suppose we want to return all of Joe's books
- "return" → delete rows from the `CheckedOut` table
  - But which ones? We want the query to be dynamic.

Ponder

- Suppose we want to checkin all of Joe's books
- "checkin" → delete rows from the `CheckedOut` table
  - But which ones? We want the query to be dynamic.
- `DELETE FROM CheckedOut WHERE …`

`WHERE` clause works same as with `SELECT`

`=, IN, EXISTS, > ANY, …`

Ponder

- What if the delete condition requires a join?

```
DELETE FROM
   CheckedOut join Patrons WHERE …
```

Ponder

- What if the delete condition requires a join?

```
DELETE FROM
   CheckedOut join Patrons WHERE …
```

`DELETE` a row from a temporary table?

Delete with Join Condition

- What if the delete condition requires a join?

```
DELETE CheckedOut FROM
   CheckedOut join Patrons WHERE …
```

- Specify which original table to delete from

Dynamic Insert

- Suppose we want to checkout <book title> for <patron name>

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

- But `CheckedOut` table has neither of those columns

Dynamic Insert

- Inserted values can be result of a select

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

```
INSERT INTO CheckedOut
  VALUES( (SELECT …), (SELECT …))
```

Nested `SELECT`s must have one row

Dynamic Insert

- What if the book is already checked out?

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

```
INSERT INTO CheckedOut
  VALUES( (SELECT …), (SELECT …))
```

- MySQL reports an error (which throws an exception in C#)

Dynamic Insert

- What if the book is already checked out?

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

```
INSERT IGNORE INTO CheckedOut
  VALUES( (SELECT …), (SELECT …))
```

- Converts errors to warnings

Exercise

- Write a query to checkout “The Lorax” for “Joe”
  - There may be multiple copies of “The Lorax”
  - Some or all of them might already be checked out

Exercise

Patrons

Name	CardNum
Joe	1
Ann	2
Ben	3
Dan	4

Inventory

Serial	ISBN
1001	978-0590353427
1002	978-0590353427
1003	978-0679732242
1004	978-0394823379
1005	978-0394823379

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

Phones

CardNum	Phone
1	555-5555
2	666-6666
3	777-7777

1. Checkout "The Lorax" for "Joe", if available

Titles

ISBN	Title	Author
978-0590353427	Harry Potter	Rowling
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3 Valued Logic

- `5 == NULL`
- Read this as: “is 5 equal to an unknown value?”
  - The answer is: “unknown”
  - The answer is **not** false

3 Valued Logic

- Calculate letter grade base on score + extra credit?

```
select case
  when (score + extra) > 93 then 'A'
  ...
```

Scores

sID	Score	Extra Cred
1	100	10
2	85	NULL
3	80	10
4	100	NULL

3 Valued Logic

- Calculate letter grade base on score + extra credit?

```
select case
  when (score + extra) > 93 then 'A'
  ...
```

will be null sometimes (and thus not > 93)

Scores

sID	Score	Extra Cred
1	100	10
2	85	NULL
3	80	10
4	100	NULL

COALESCE

- Returns the first non-null item from its input

```
COALESCE(NULL, NULL, 7, NULL, 15) → 7
```

COALESCE

- Usually more useful with dynamic inputs:

```
SELECT
   COALESCE(extra_credit, 0) from Scores
```

- If `extra_credit` is not null, returns it, otherwise `0`

Who Does What?

- MySQL server can do many things:
  - Sort
  - Select
  - Compute
  - Average
  - Filter

- Programmers can do many things:
  - Sort
  - Select
  - Compute
  - Average
  - Filter

Let MySQL Work for You

- It's probably faster/better at it
- It has an optimizing plan generator

Let MySQL Work for You

- It's probably faster/better at it
- It has an optimizing plan generator
- …but, don't contort your brain if there is no natural SQL solution

Exam Content

- The following is a non-exhaustive example of what you might see on the test

Exam Content

- Relational model (HW 1)
  - Relation definitions *and their meaning*
  - Representing data using RM
  - Keys, Superkeys, set logic
  - Foreign keys
  - Integrity constraints

Exam Content

- Entity-Relationship model (HW2 & Phase 1)
  - Interpreting diagrams
  - Diagrams to English
  - English to diagrams
  - Diagrams to schemas
    - What are the rules and why?

Exam Content

- Relational algebra (HW3)
  - Relations
  - Relational operators
  - Composing queries
  - Differences between pure RA and SQL

Exam Content

- SQL (HW4)
  - Creating/dropping tables
  - Insert/delete
  - Select
  - Filters and operators
  - Differences between RA and SQL

Examples

- Given some tables with various constraints (NN, FK, PK, etc…)
  - Is <some instance> valid?
  - Which of <some English statements> are true of this table?

Examples

- Given some concrete instance of a relation
  - What will <some RA query> return?
  - Write a query to return <English description>
- Given some abstract relation (no instance)
  - Write an RA query to find <English description>
  - Describe in English what <some RA query> is looking for

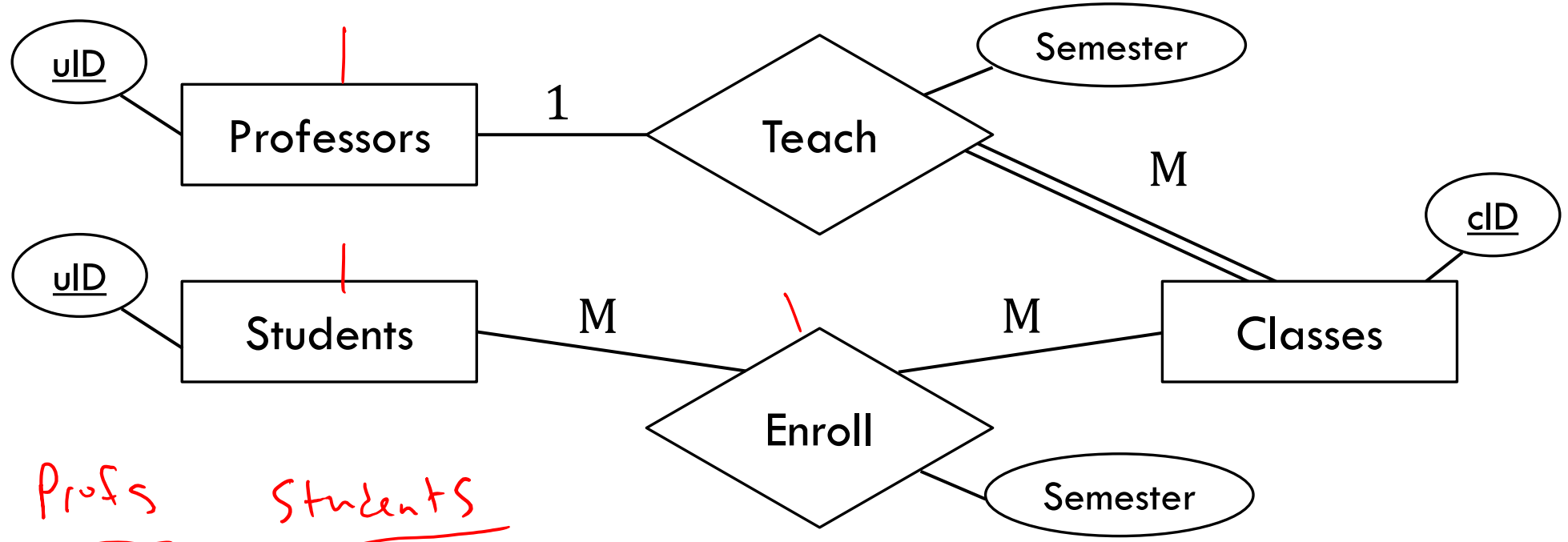
Examples

- … same as previous slide, but with SQL

Examples

- Given some ER diagram, which of the following is true?
  - "… at least one …"
  - "… exactly one …"
  - "… at most one …"
  - etc

Practice



Profs
uID
NN
PK

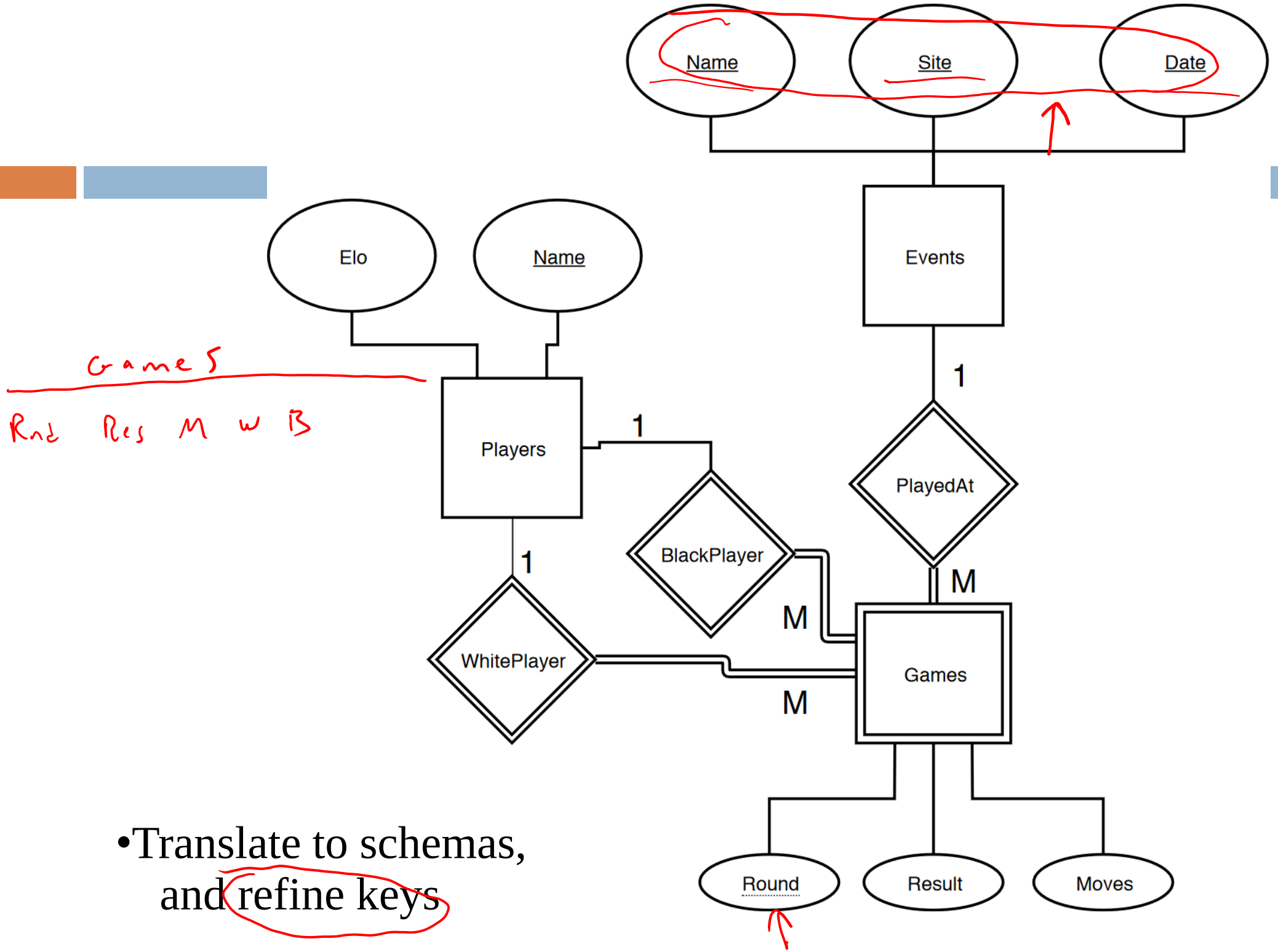
Students

Enroll
Sem
NN
uID
NN
FK
cID
NN
FK
PK

classes
cID
NN
PK
Sem
NN
uID
NN
FK

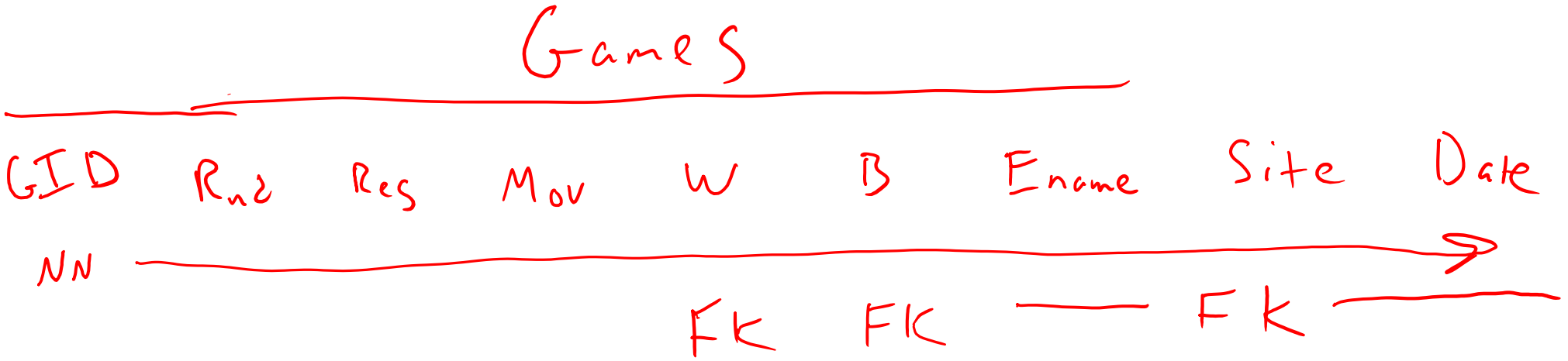
- Translate to schemas

Practice



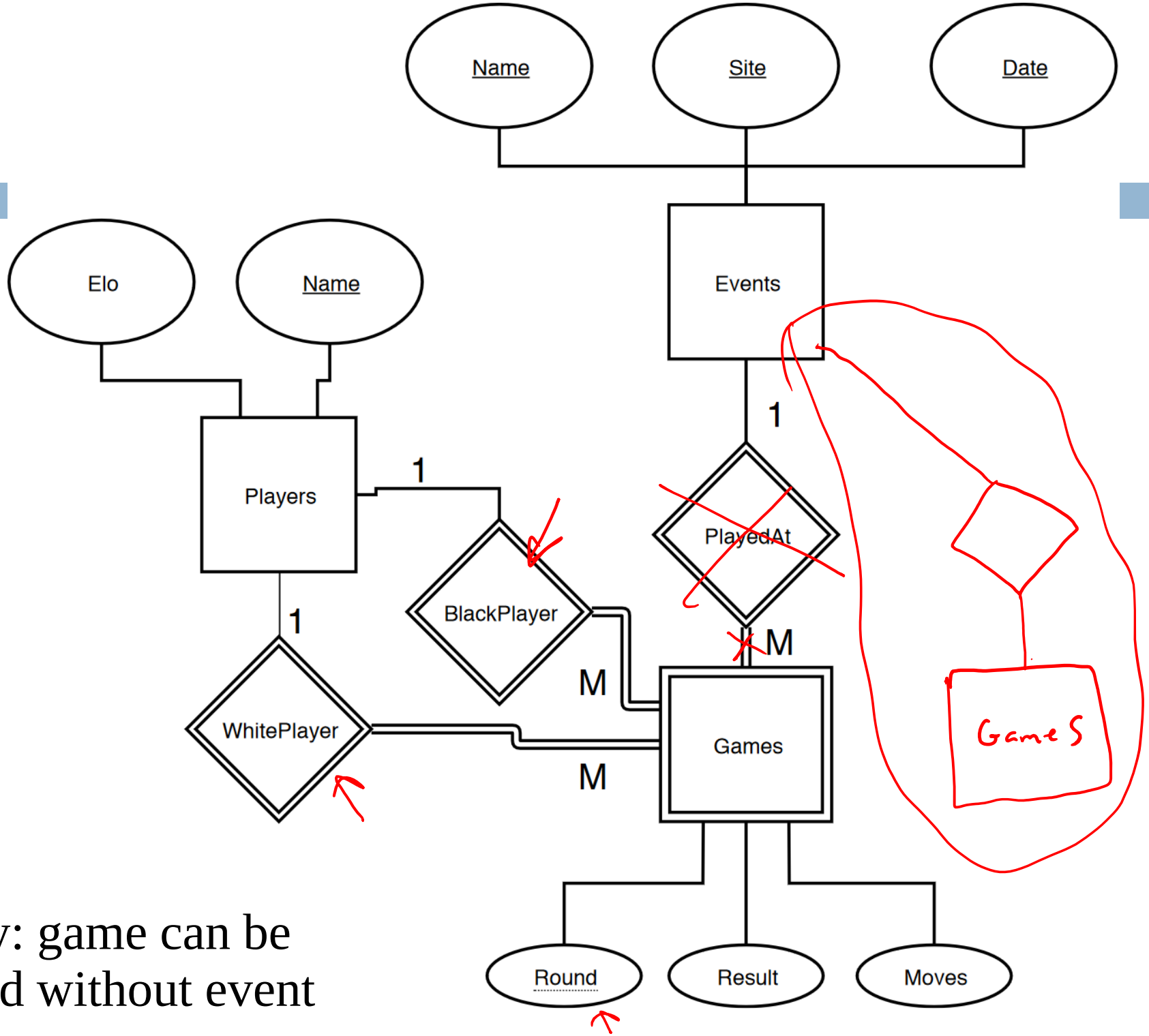
- Translate to schemas, and refine keys

Practice



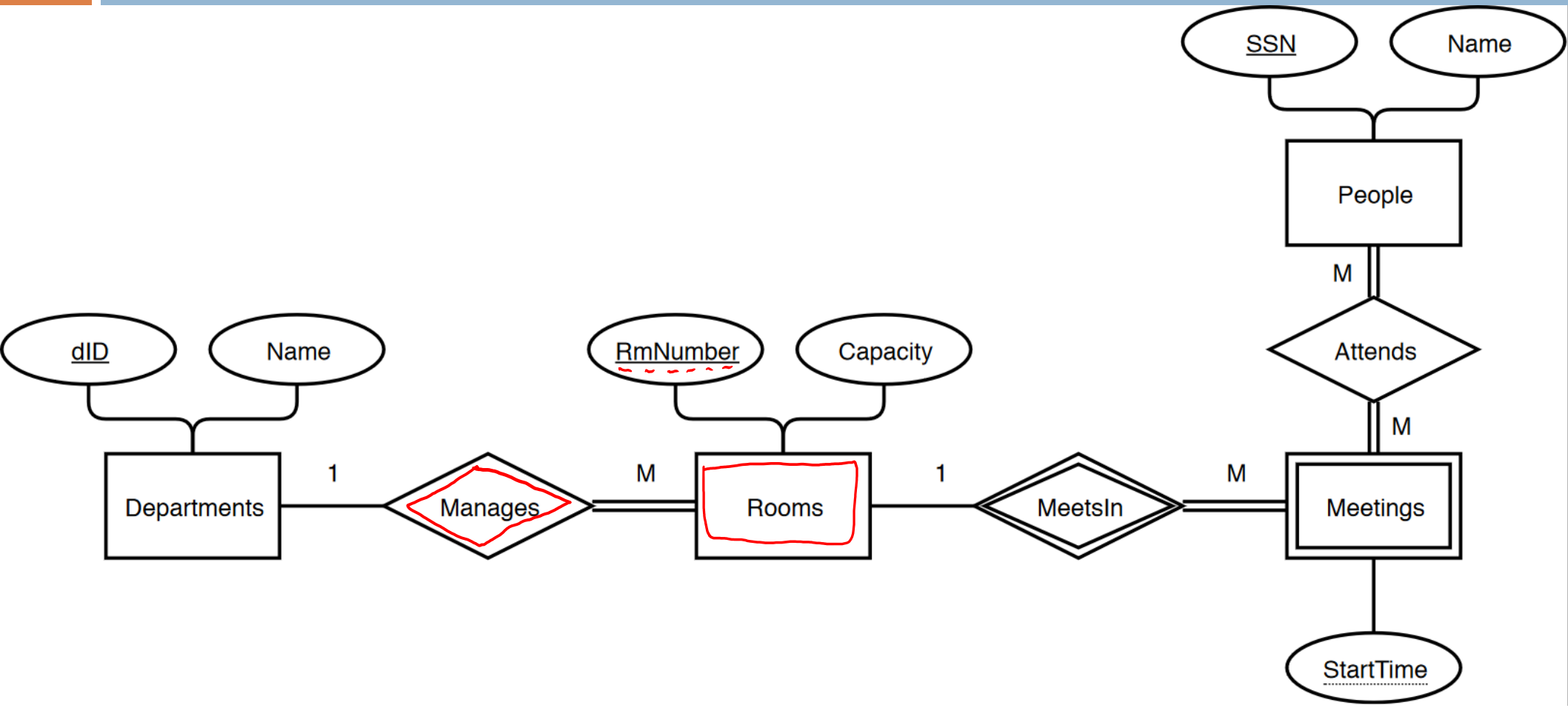
→ UQ(Rnd, W, B, EName, Site, Date)

PK (GID)



- Modify: game can be played without event

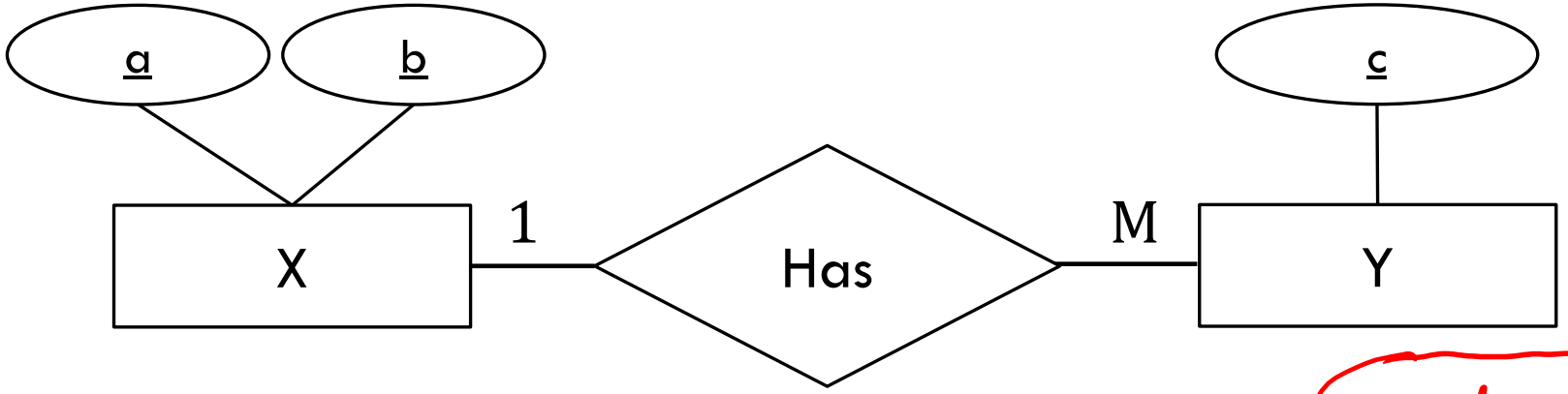
Midterm Practice



- Modify: rooms can have the same room number, but not within the same department

Practice

- Provide SQL



Create table X (a ... NN , b ... NN , PK(a,b));

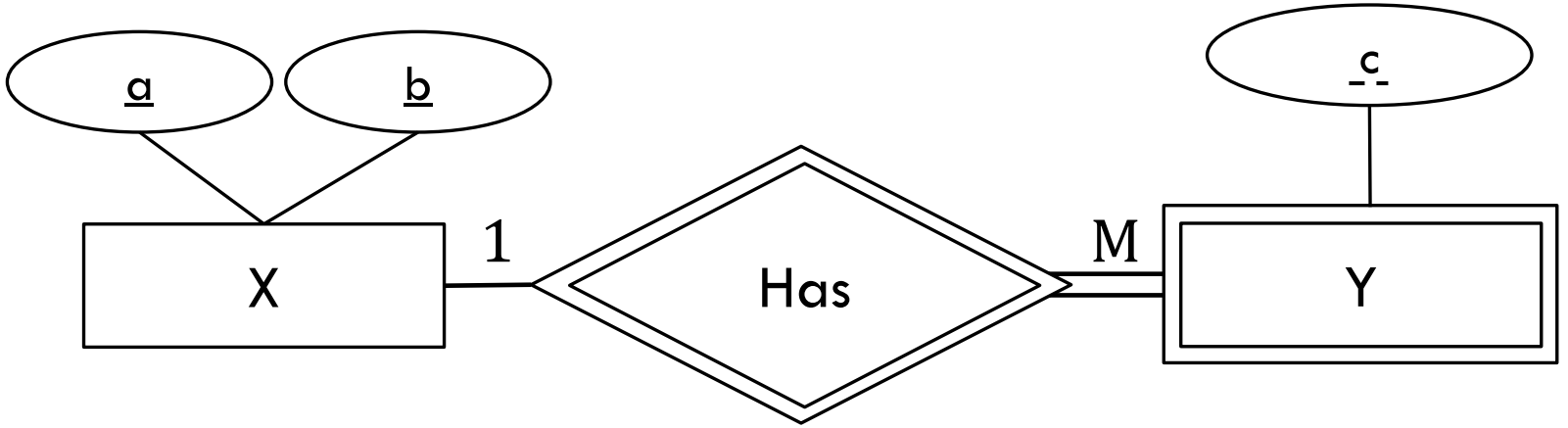
..... Y (c ... NN , a ... , b ... ,

pk(c) ,

FK(a,b) ref X (a,b))

Practice

- Provide SQL



create table Y (c ... NN , a ... NN , b ... NN ,

pk (c , a , b)

...

Practice

Inventory

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1001	978-0590353427
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Patrons

Name	CardNum
Joe	1
Ann	2
Ben	3
Dan	4

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

Phones

CardNum	Phone
1	555-5555
2	666-6666
3	777-7777
4	888-8888
4	999-9999

How many rows in:
SELECT * FROM Patrons, Phones, CheckedOut, Inventory, Titles;

Titles

ISBN	Title	Author
978-0590353427	Harry Potter	Rowling
978-0679732242	The Sound and the Fury	Faulkner
978-0394823379	The Lorax	Seuss
978-0062278791	Profiles in Courage	Kennedy
978-0441172719	Dune	Herbert

Practice

Inventory

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Patrons

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CheckedOut

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Phones

CardNum	Phone
1	555-5555
2	666-6666
3	777-7777
4	888-8888
4	999-9999

$\pi_{Author}(I \times Pa \times \ldots)$

How many rows in:
SELECT Author FROM Patrons, Phones, CheckedOut, Inventory, Titles;

Titles

ISBN	Title	Author
978-0590353427	Harry Potter	Rowling
978-0679732242	The Sound and the Fury	Faulkner
978-0394823379	The Lorax	Seuss
978-0062278791	Profiles in Courage	Kennedy
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Practice

Patrons

Name	CardNum
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Ben	3
Dan	4

CheckedOut

CardNum	Serial
1	1001
1	1004
4	1005
4	1006

How many rows in:

```
SELECT * FROM
Patrons  p LEFT JOIN CheckedOut c
ON p.CardNum = c.CardNum;
```

Practice

- Provide RA query to find sID pairs of friends
  - (pairs of people in the same class)

Enrolled

sID	cID	Grd
1	3500	A
1	3810	A-
1	5530	A
2	3810	A
2	5530	B
3	3500	C
3	3810	B
4	3500	C

Practice

- Provide RA query to find sIDs of people who have earned every known grade

Enrolled

sID	cID	Grd
1	3500	A
1	3810	A-
1	5530	A
2	3810	A
2	5530	B
3	3500	C
3	3810	B
4	3500	C

Practice

- Provide SQL query to find the Name of the Patron with the most phone numbers

Patrons

Name	CardNum
Joe	1
Ann	2
Ben	3
Dan	4

Phones

CardNum	Phone
1	555-5555
2	666-6666
3	777-7777
4	888-8888
4	999-9999

Practice

- Provide SQL query to find average student age of each course

Students

sID	Name	DOB
1	Hermione	1980
2	Harry	1979
3	Ron	1980
4	Malfoy	1982

Enrolled

sID	cID	Grd
1	3500	A
1	3810	A-
1	5530	A
2	3810	A
2	5530	B
3	3500	C
3	3810	B
4	3500	C

Courses

cID	Name
3500	SW Practice
3810	Architecture
5530	Databases