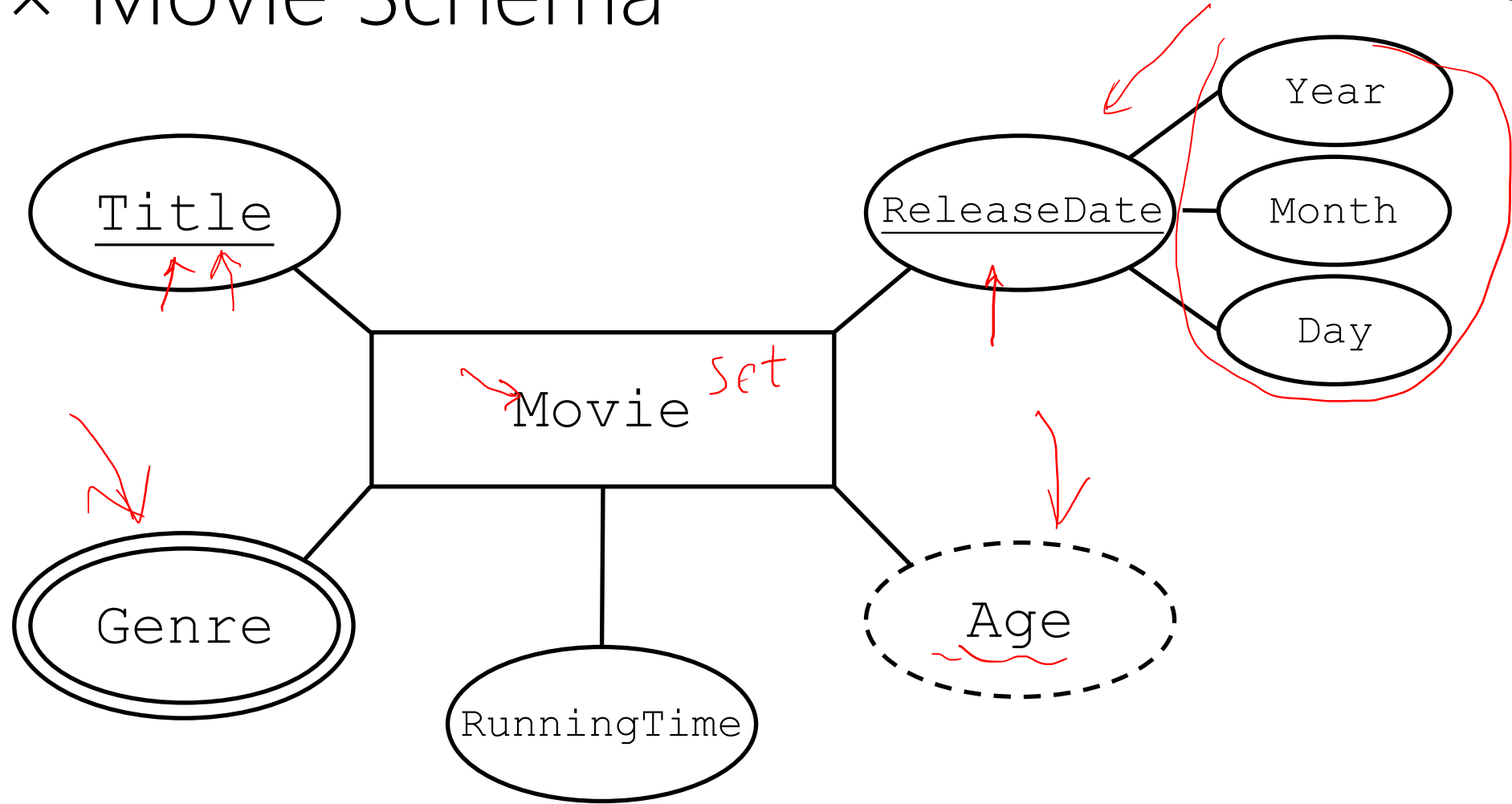




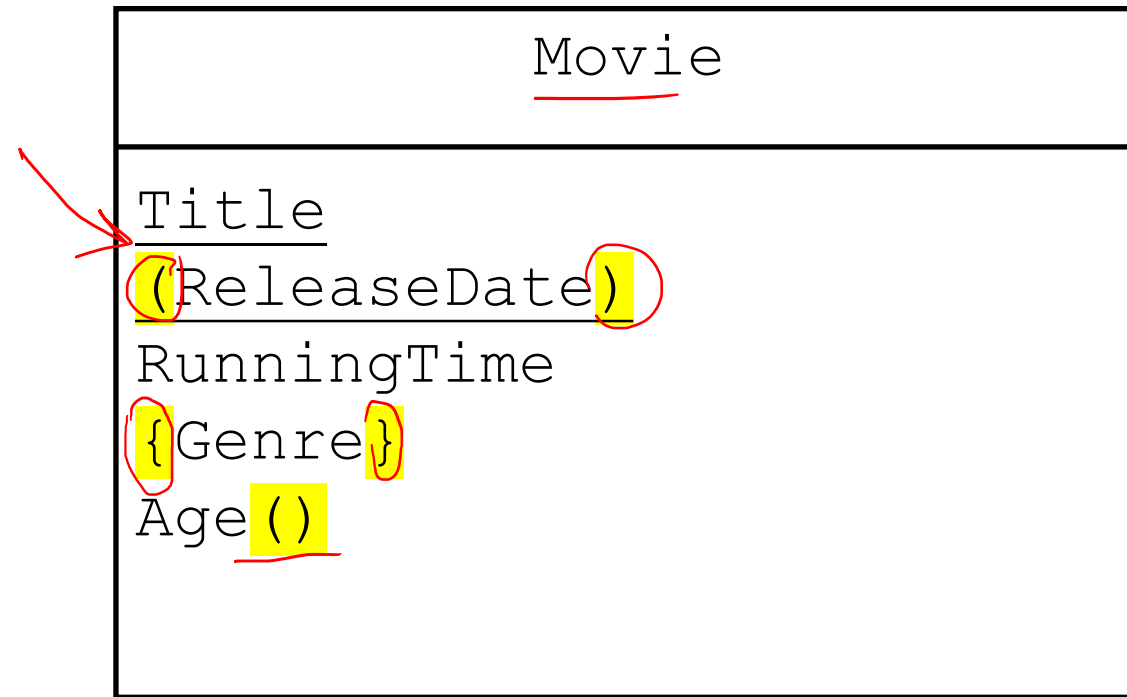
E/R × Movie Schema

2



E/R × Attribute

3



E/R × Relationship (r)

An association among entities

Movie (E_1)

$e_1.Title = 'The Birds'$

$e_1.ReleaseDate = March 28, 1963$

$e_1.RunningTime = 119$

$e_1.Genre = {'Drama', 'Horror', 'Mystery'}$

$e_1.Age = 51$

Director (E_2)

$e_2.Name = 'Alfred Hitchcock'$

$e_2.DateOfBirth = August 13, 1899$

$e_2.PlaceOfBirth = England$

$e_2.SSN = NULL$

$r = (e_1, e_2) = (\text{'The Birds', 'March 28, 1963'}, \text{'Alfred Hitchcock', 'August 13, 1899'})$

E/R × Relationship Set (R)

5

$r = (e_1, e_2) = (\{\text{'The Birds'}, \text{'March 28, 1963'}\}, \{\text{'Alfred Hitchcock'}, \text{'August 13, 1899'}\})$

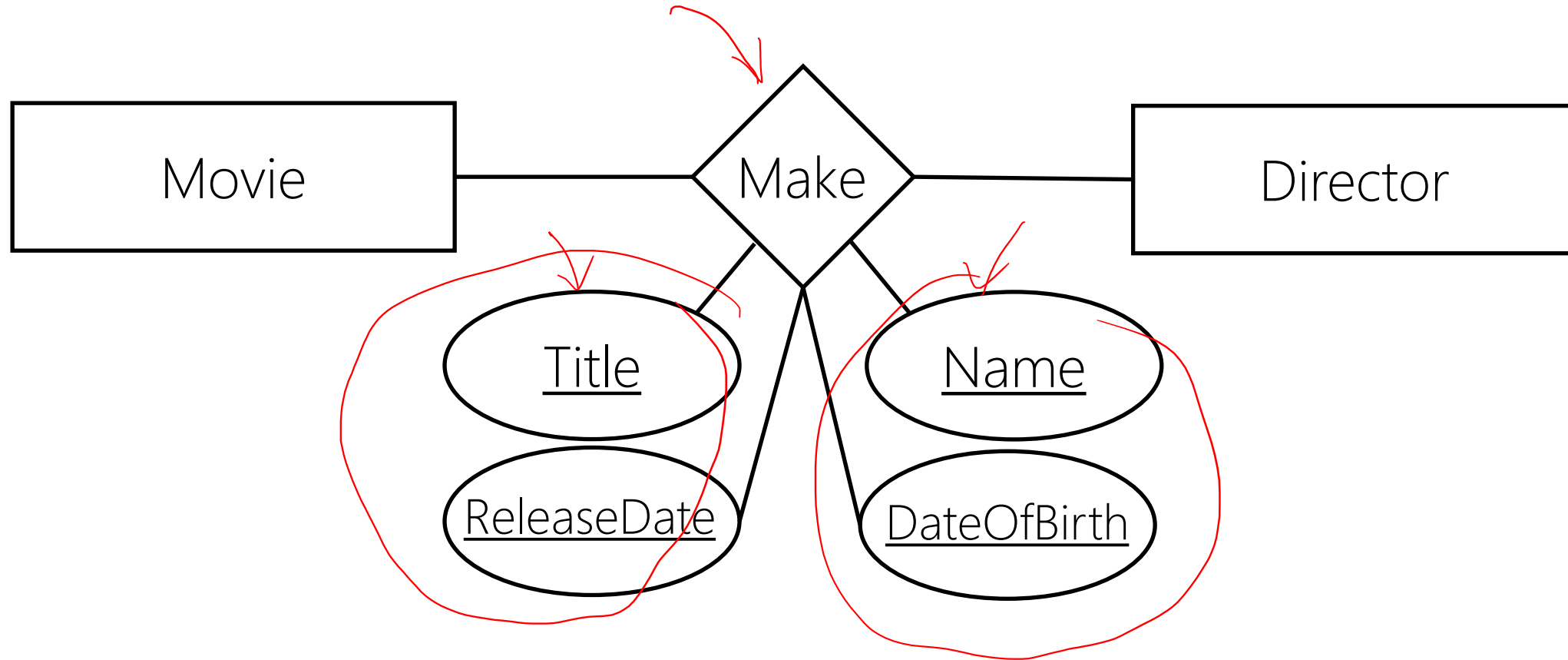
$r' = (e'_1, e'_2) = (\{\text{'Rosemary's Baby'}, \text{'June 12, 1968'}\}, \{\text{'Roman Polanski'}, \text{'August 18, 1933'}\})$

$R = \{r, r', \dots\}$

Binary Relationships

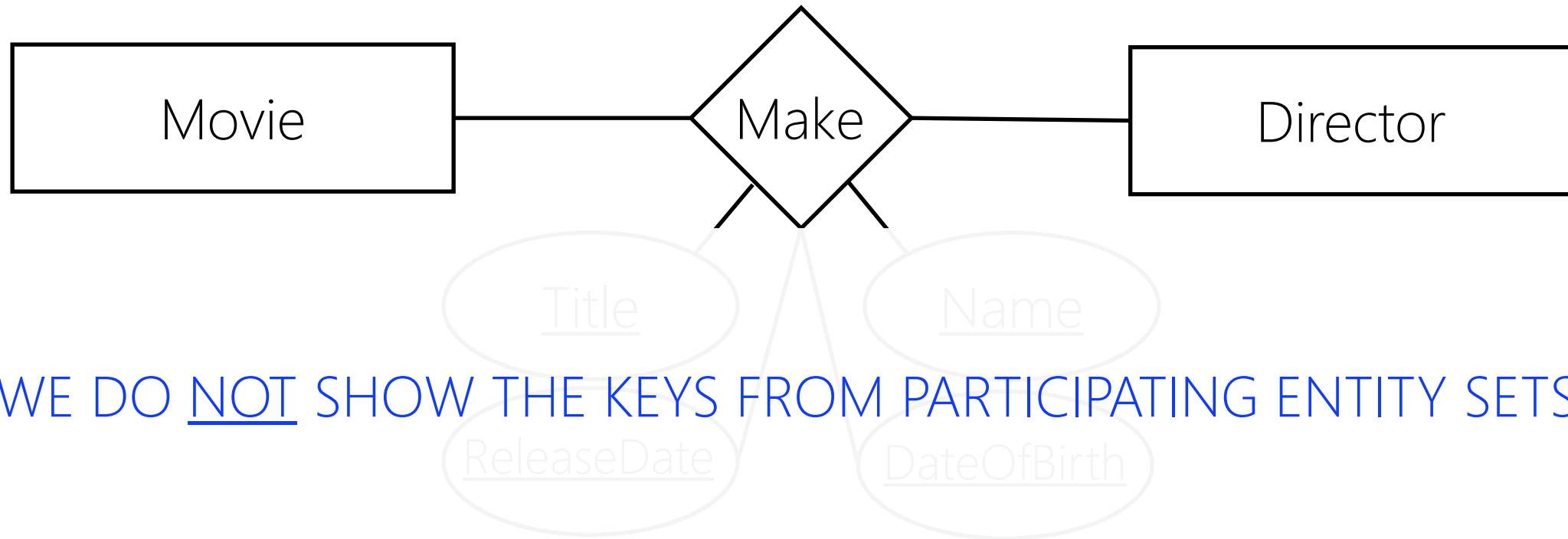
E/R × Relationship Set (R)

6



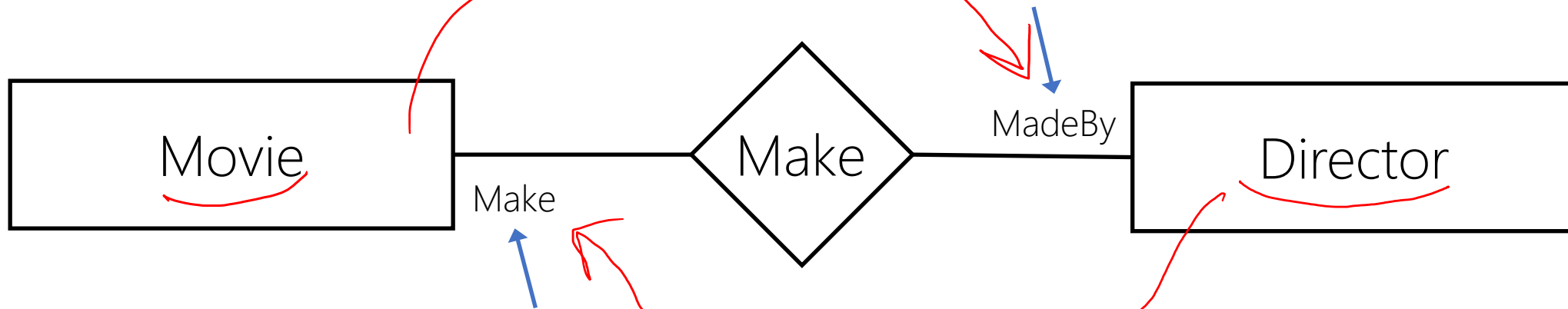
E/R × Relationship Set (R)

7



E/R × Relationship Set × Role

8

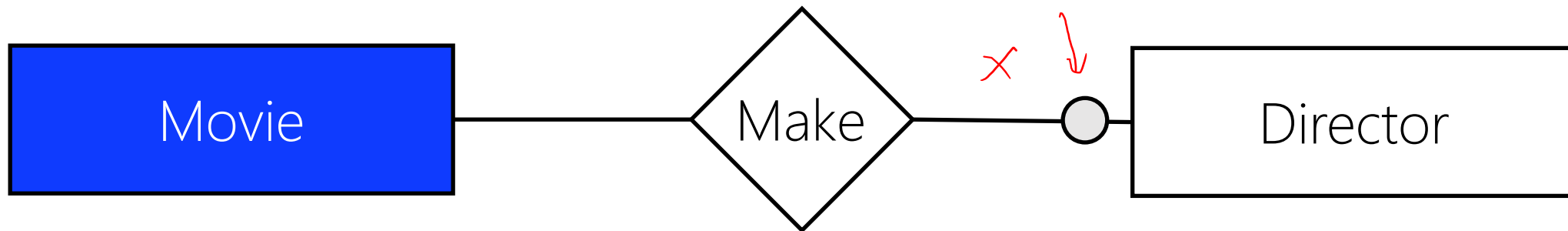
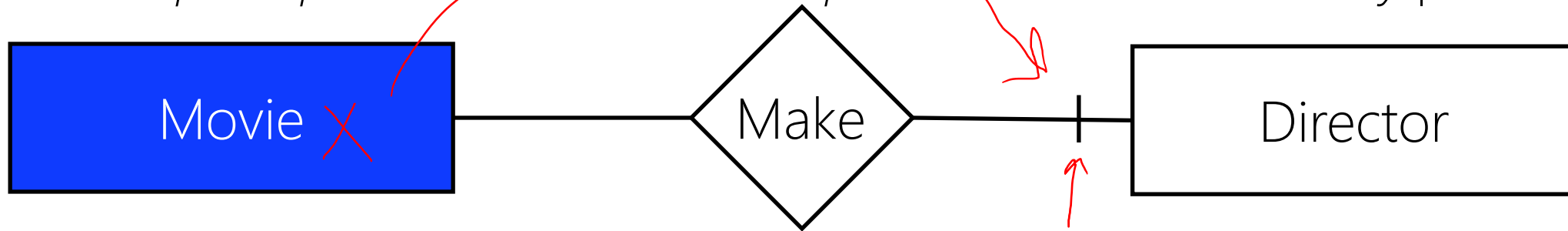


When not clear, the role in relationship SHOULD be mentioned

E/R × Relationship Set × Participation

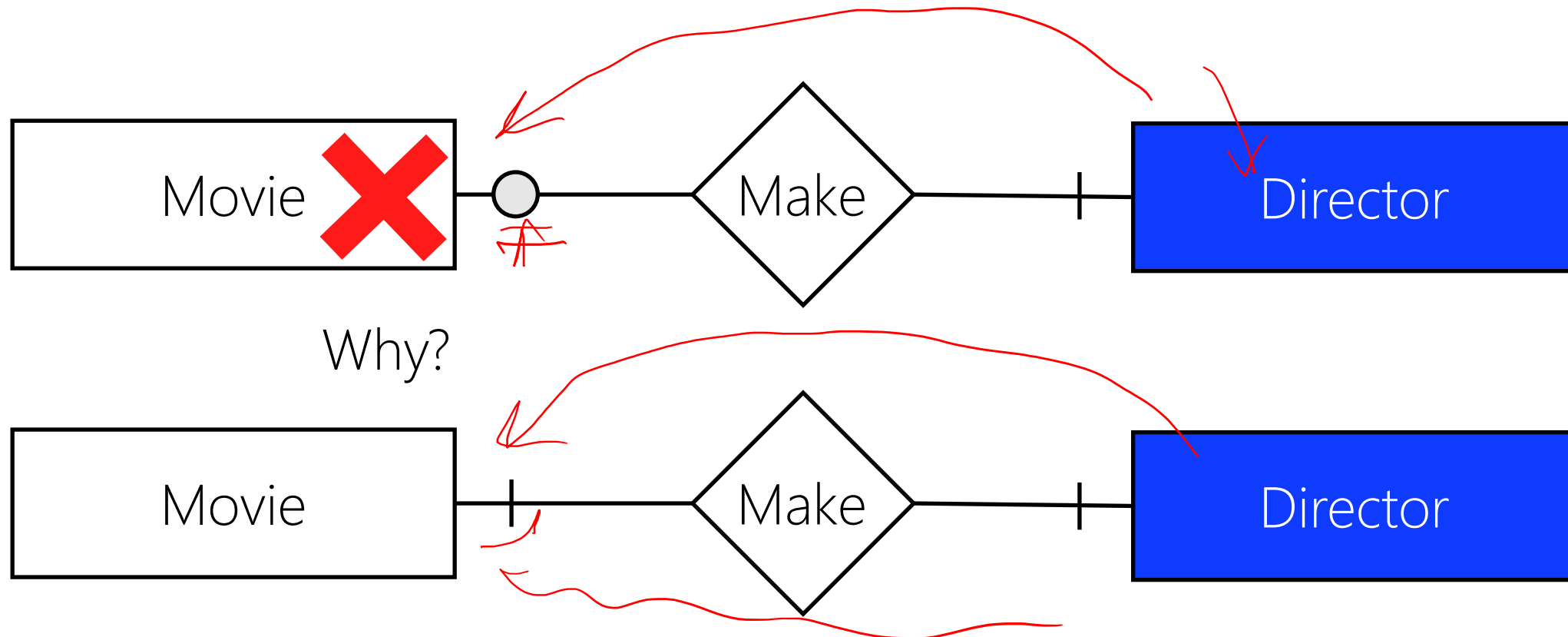
9

Movie's participation in Make relationship with Director is mandatory | total.



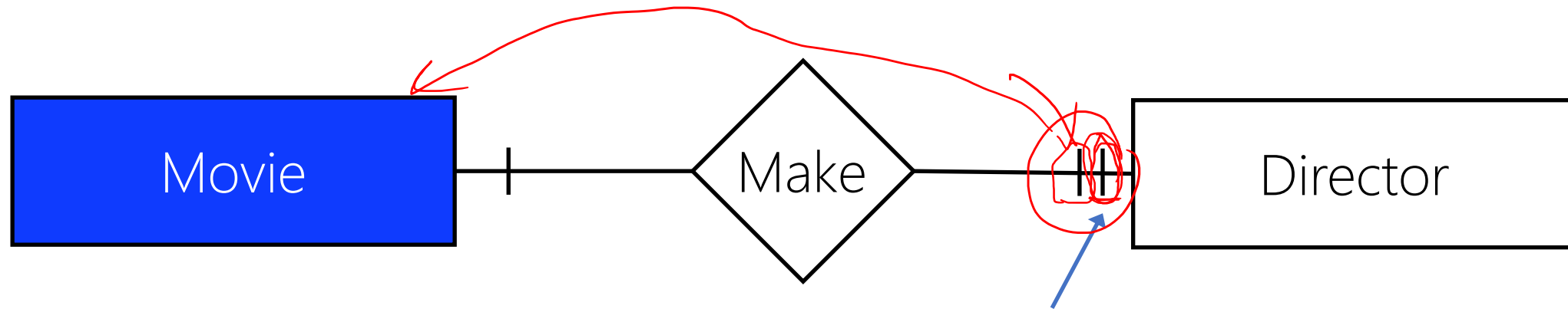
Movie's participation in Make relationship with Director is optional | partial.

E/R × Relationship Set × Participation 10



E/R × Relationship Set × Multiplicity

11

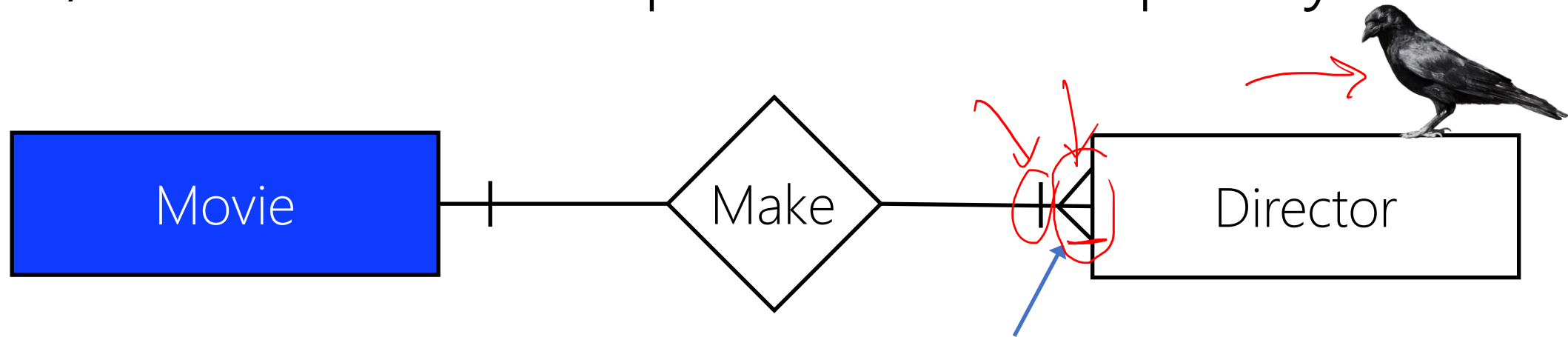


A Movie participate in Make relationship with 1 Director at max

arton Fink
rgo
Brother, Where Art Thou?
he Man Who Wasn't There
o Country for Old Men
urn After Reading
Serious Man
ue Grit
side Llewyn Davis
nbroken
idge of Spies
ail, Caesar!



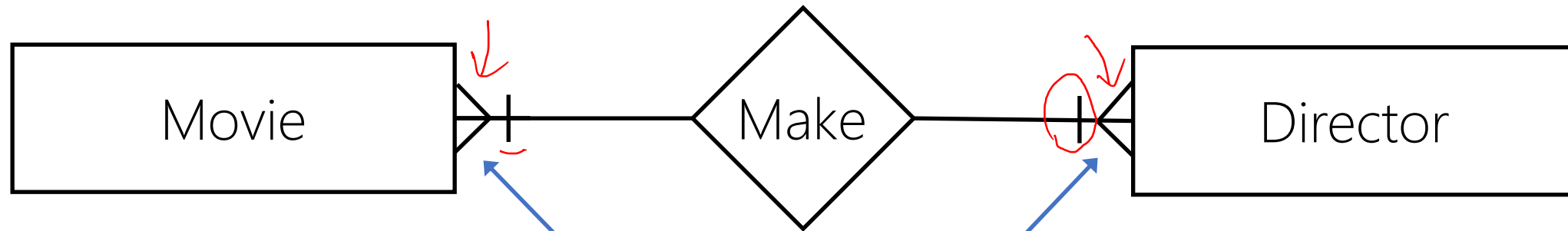
E/R × Relationship Set × Multiplicity 13



A Movie participate in Make relationship Many (More than 1) Director at max

E/R × Relationship Set × Multiplicity

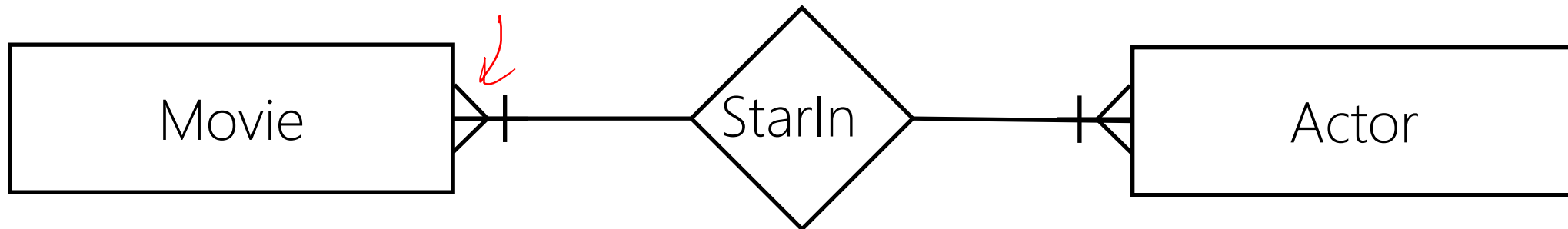
14



Make is a Many-Many Relationship (Set)

E/R × Relationship Set × Practice

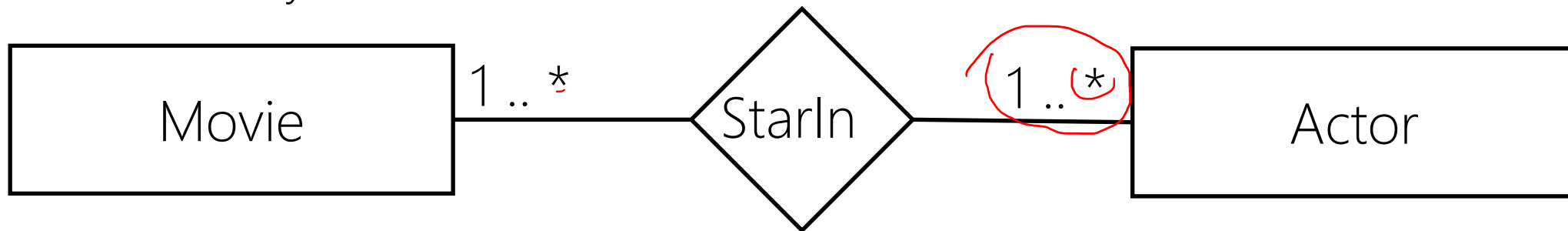
15



Multiplicity: StarIn is a Many-Many Relationship (Set)

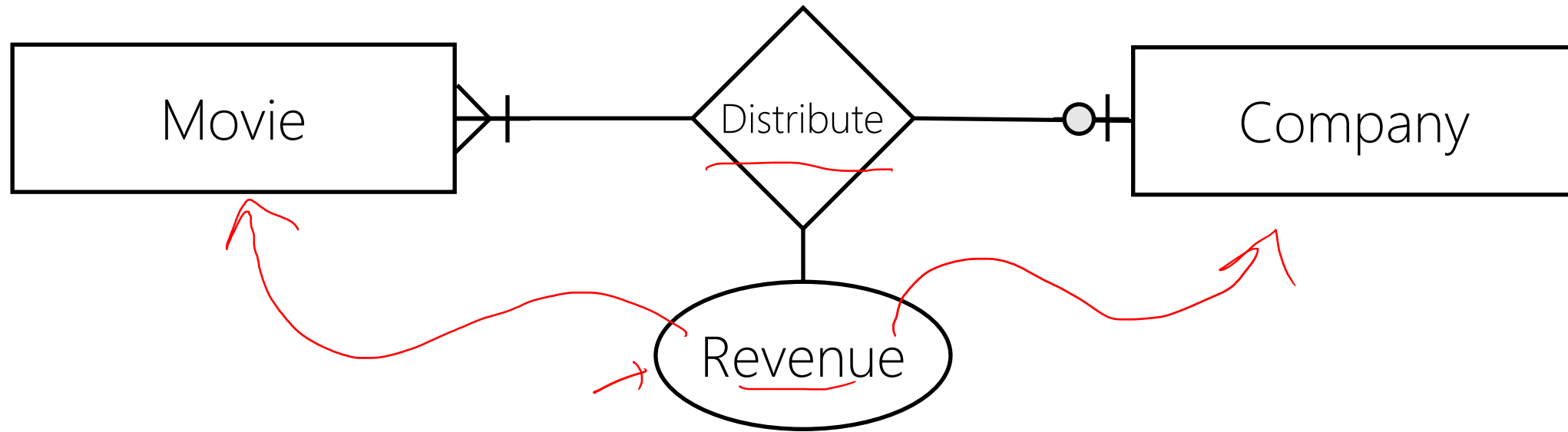
A Movie may have more than one Actor entities

An Actor may StarIn more than one Movie entities



E/R × Relationship Set × Attribute

16

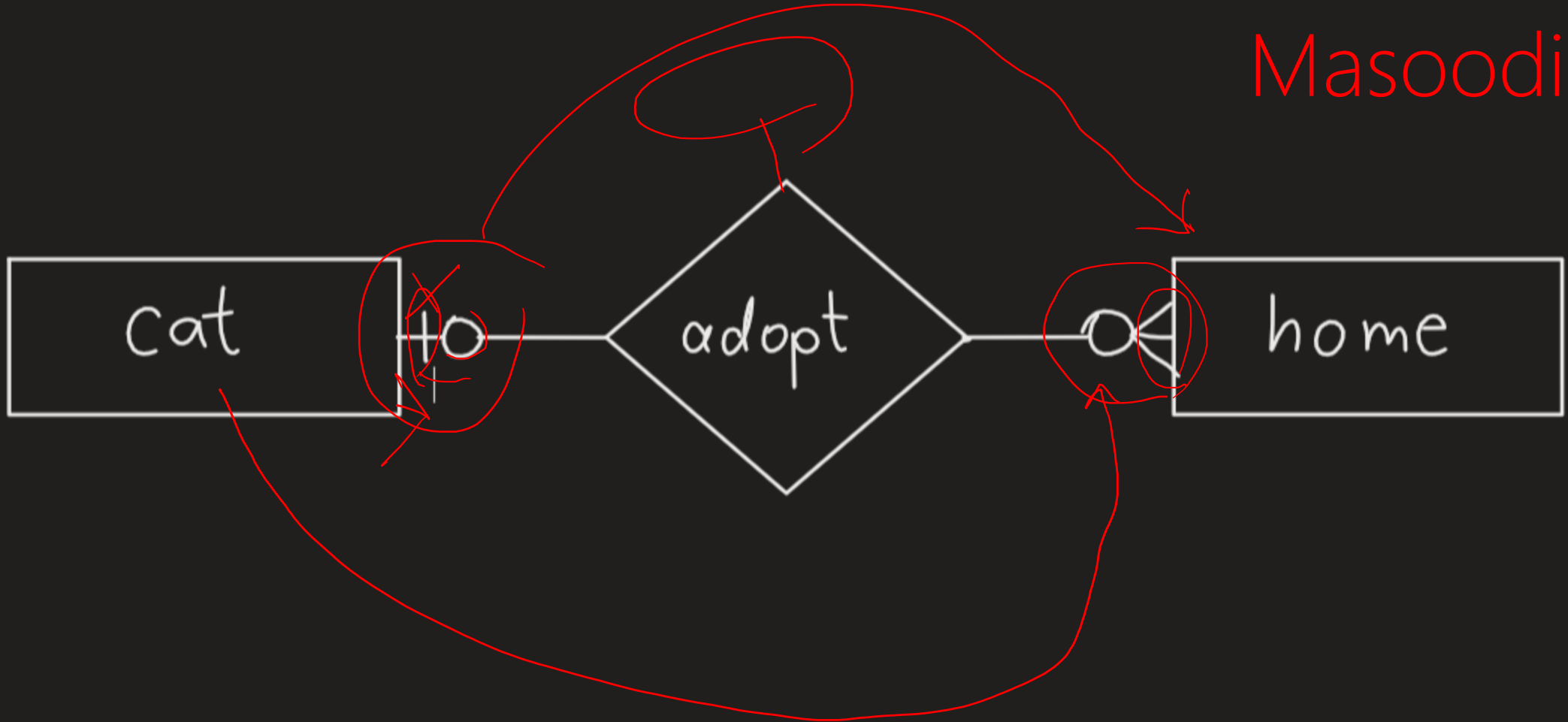


Revenue exist if and only if there is a relationship between a Movie entity and a Company entity.
e.g., 'Universal Pictures' made '\$11.4 million' by distributing 'The Birds'.

Anamta
Masoodi

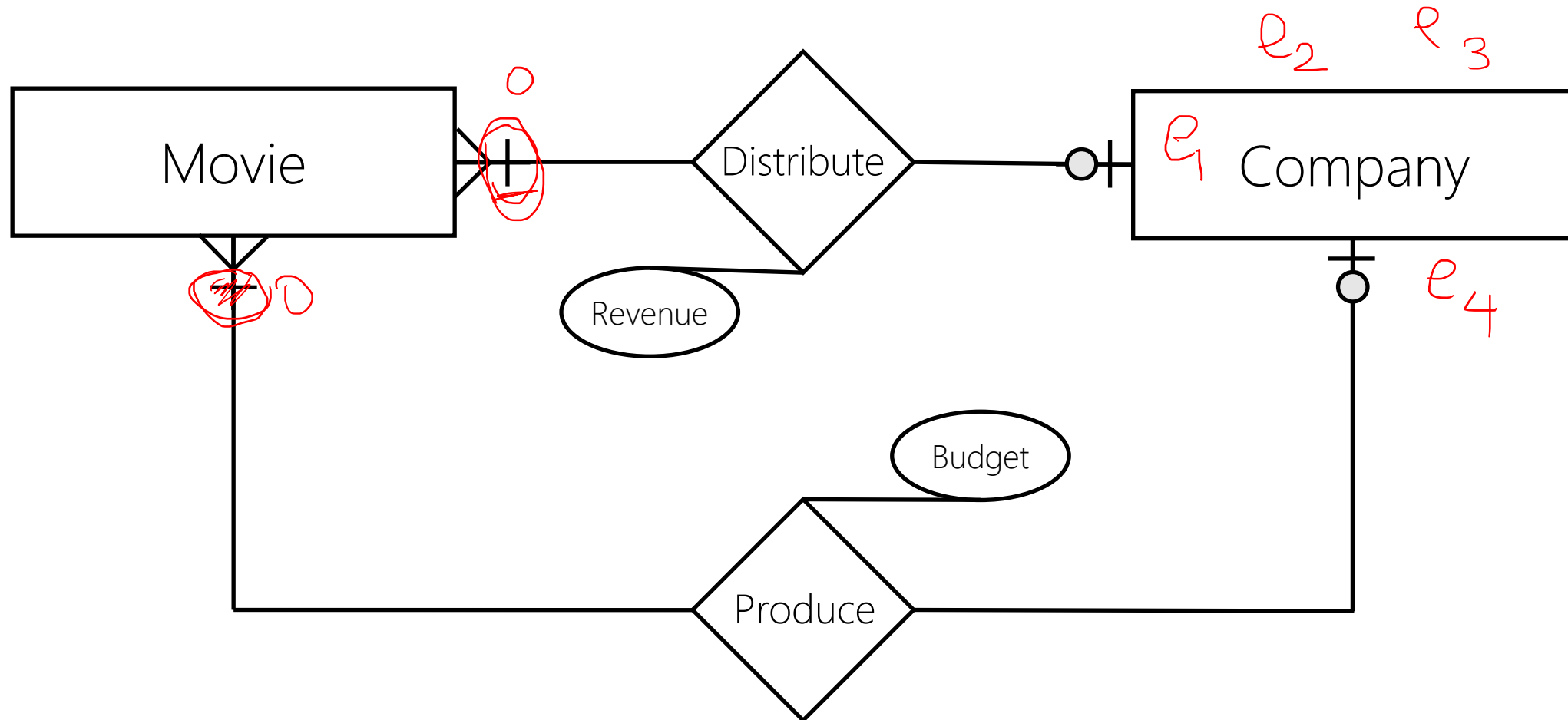


Anamta
Masoodi



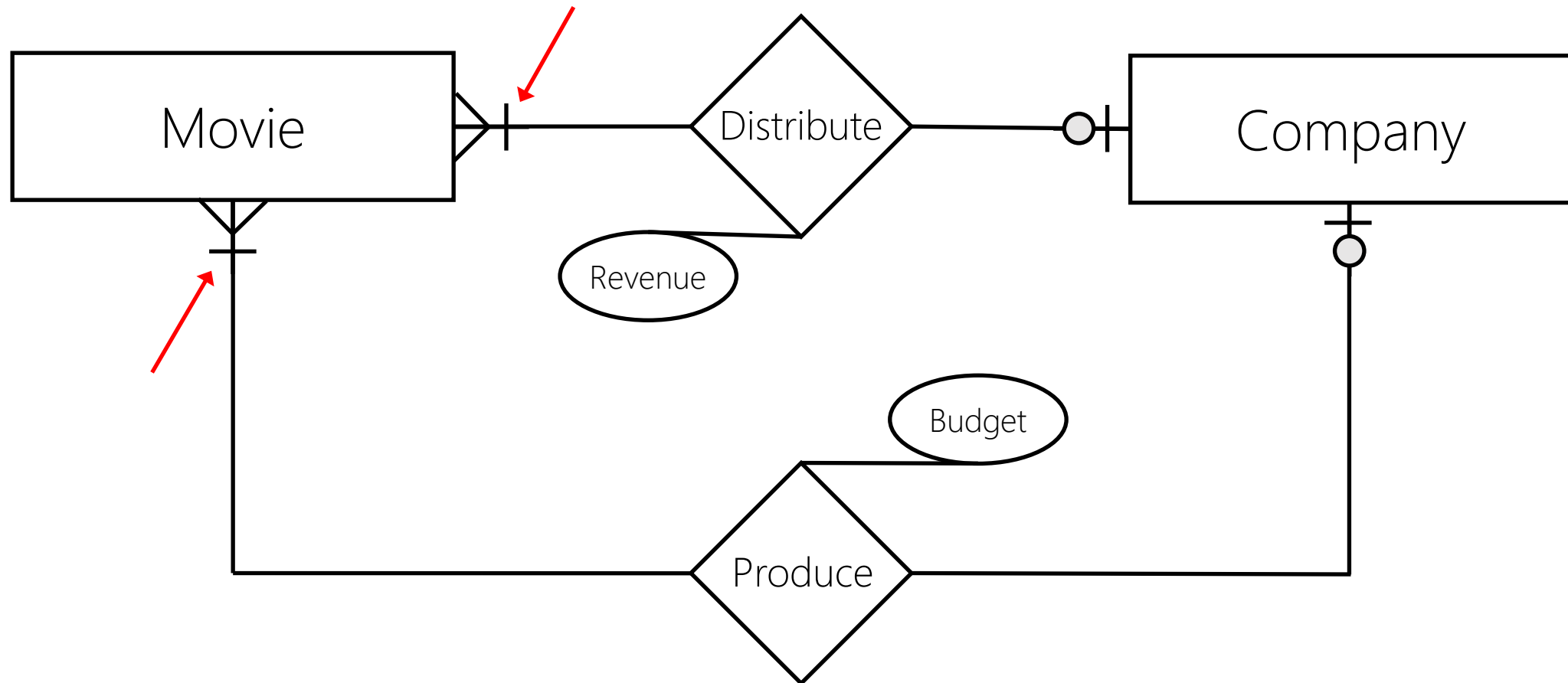
E/R × Relationship Set × Multiple

19



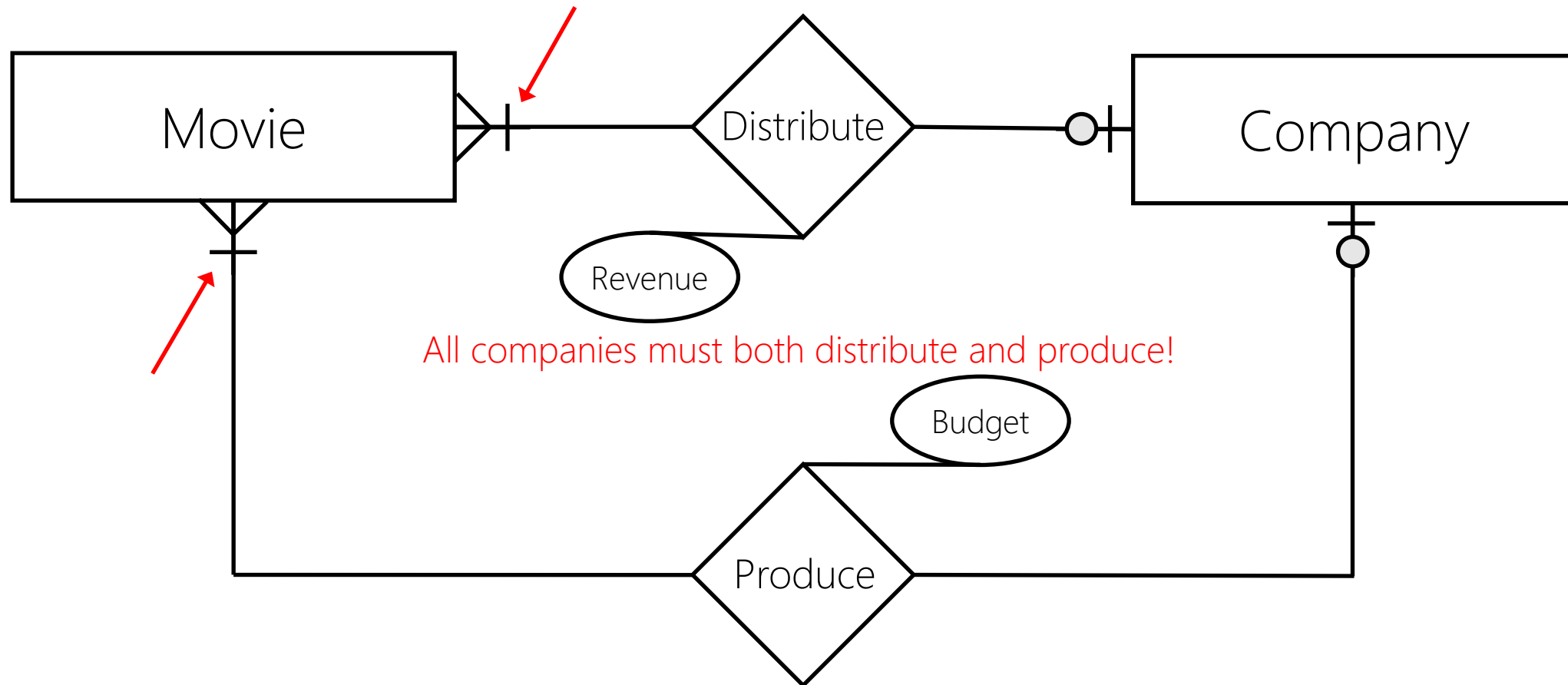
E/R × Relationship Set × Multiple

20



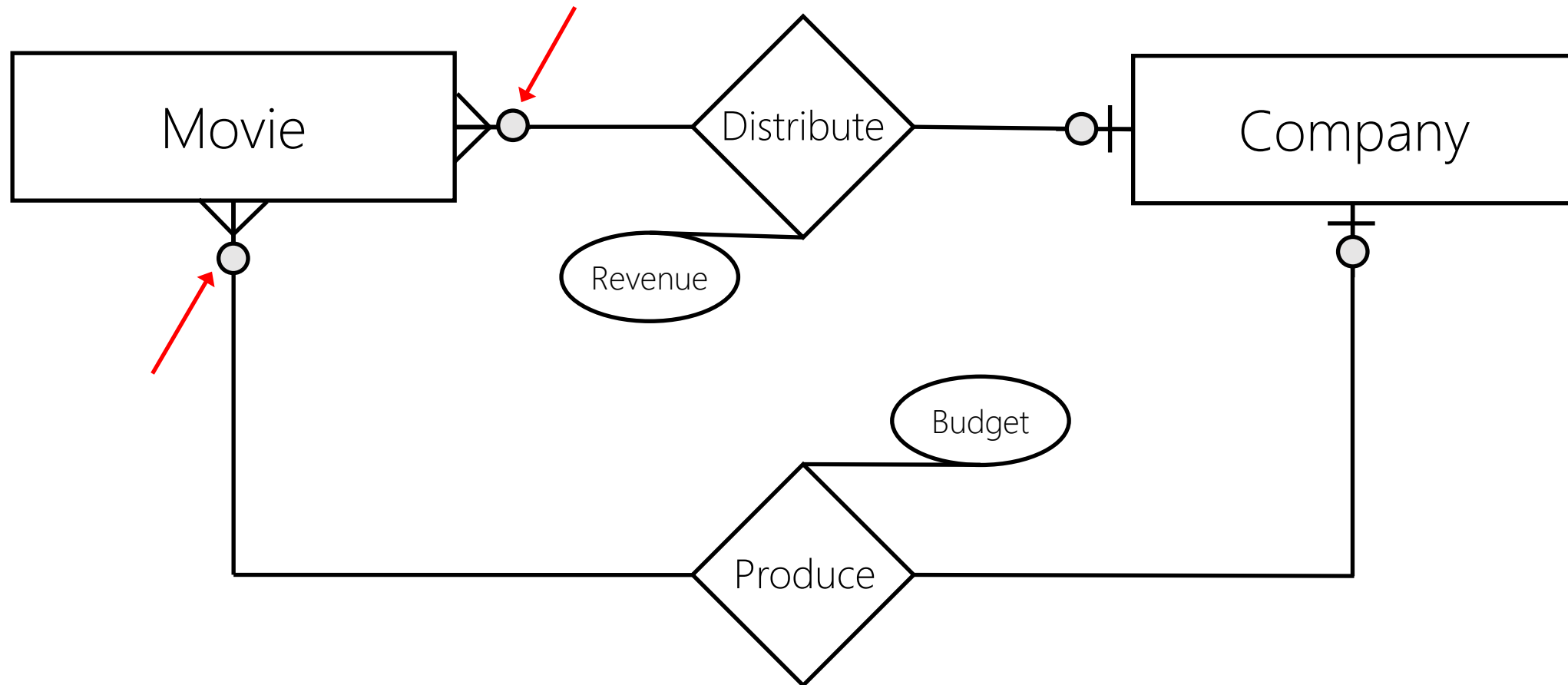
E/R × Relationship Set × Multiple

21



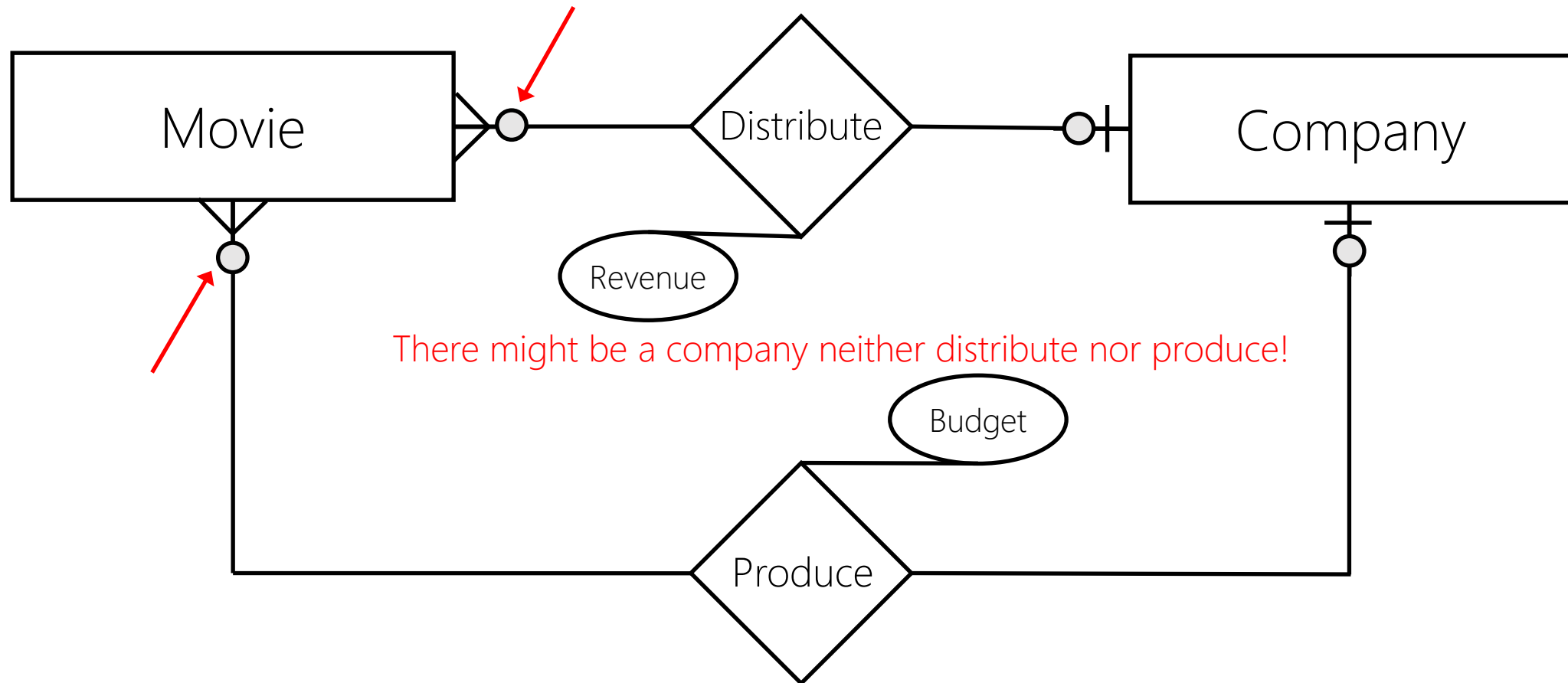
E/R × Relationship Set × Multiple

22



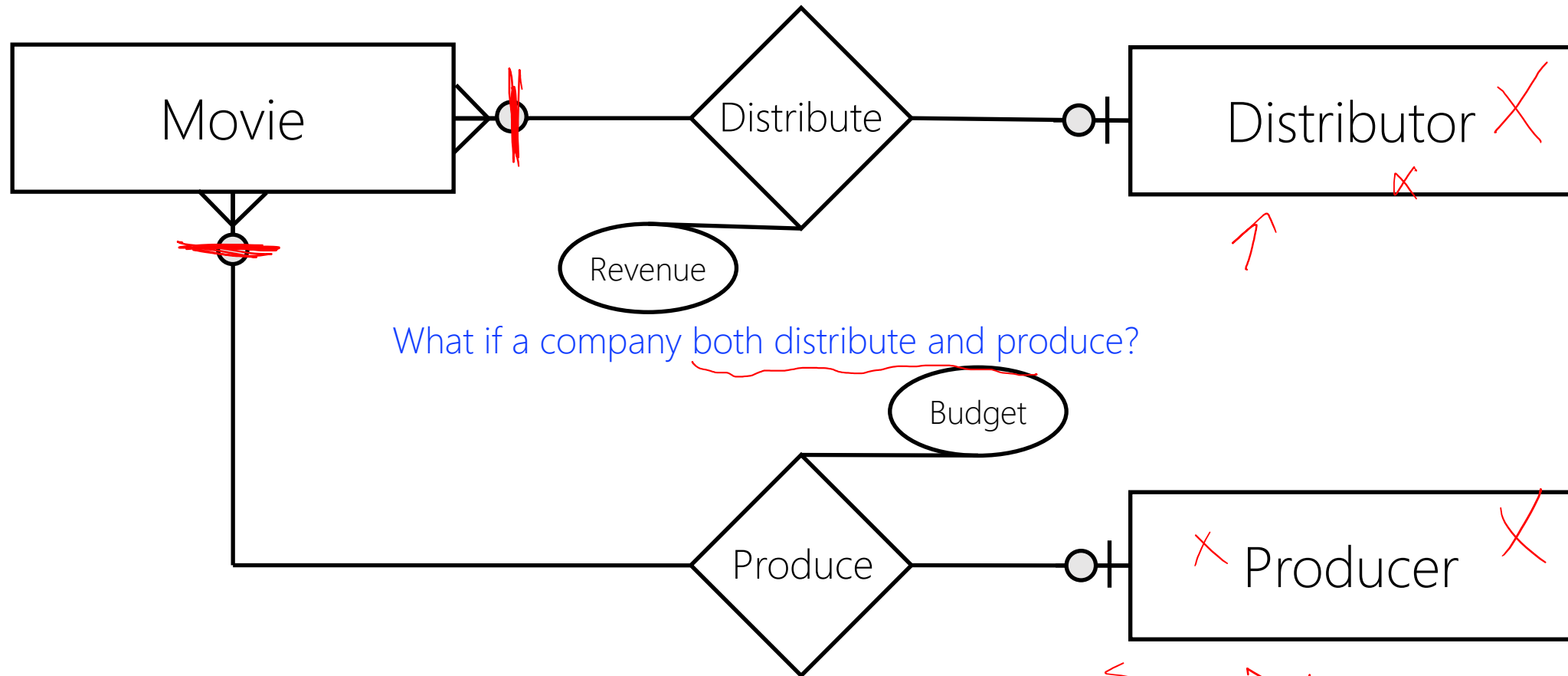
E/R × Relationship Set × Multiple

23



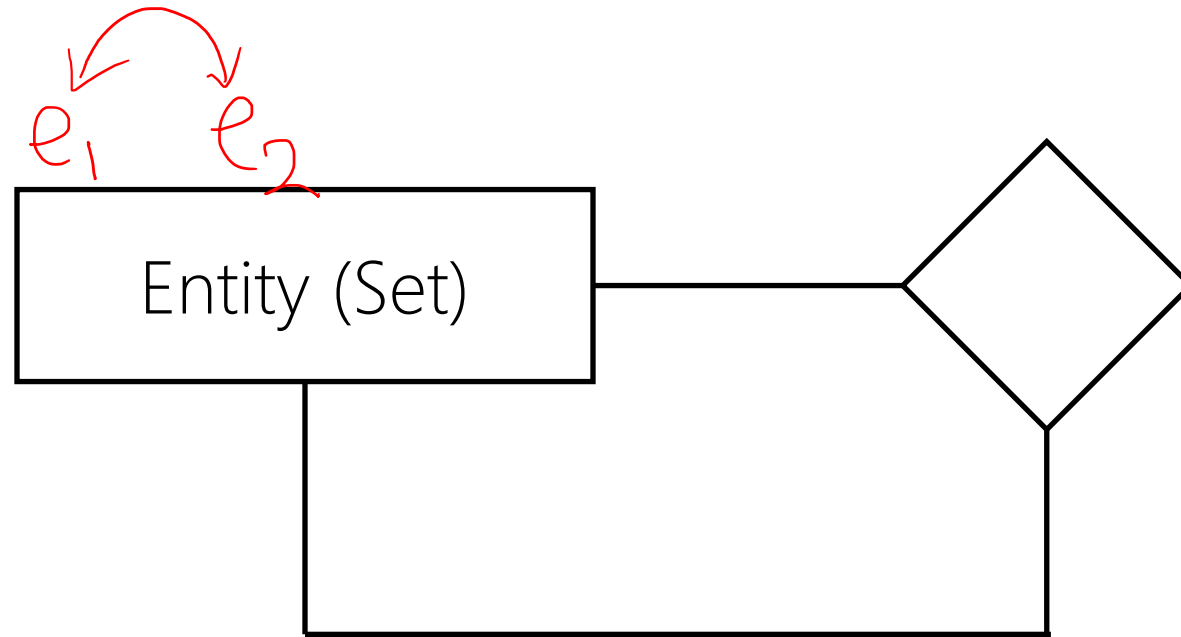
E/R × Relationship Set × Multiple

24



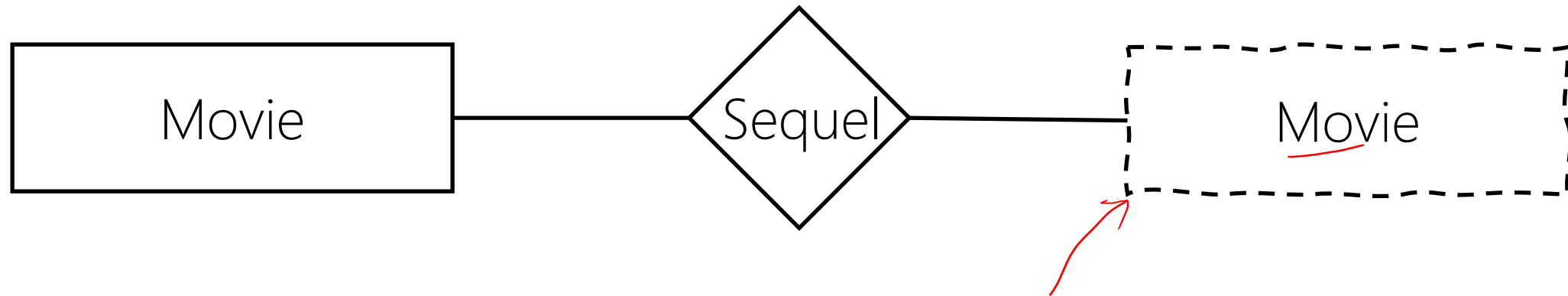
E/R \times Relationship Set \times Self (Unary)

25



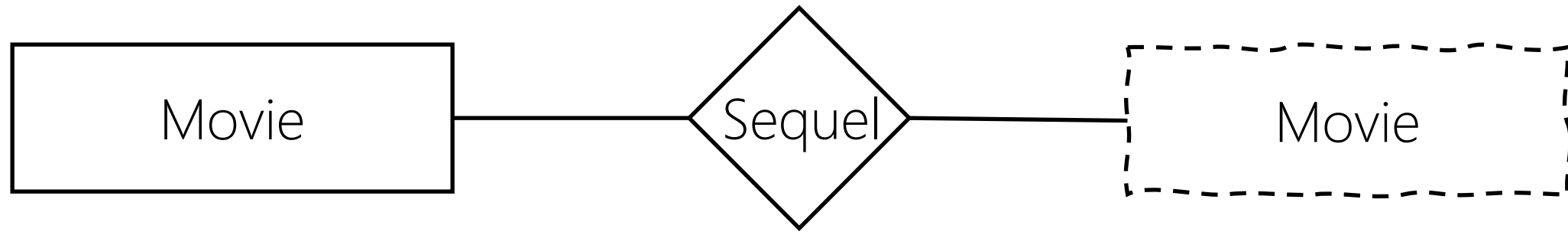
E/R × Relationship Set × Self (Unary)

26



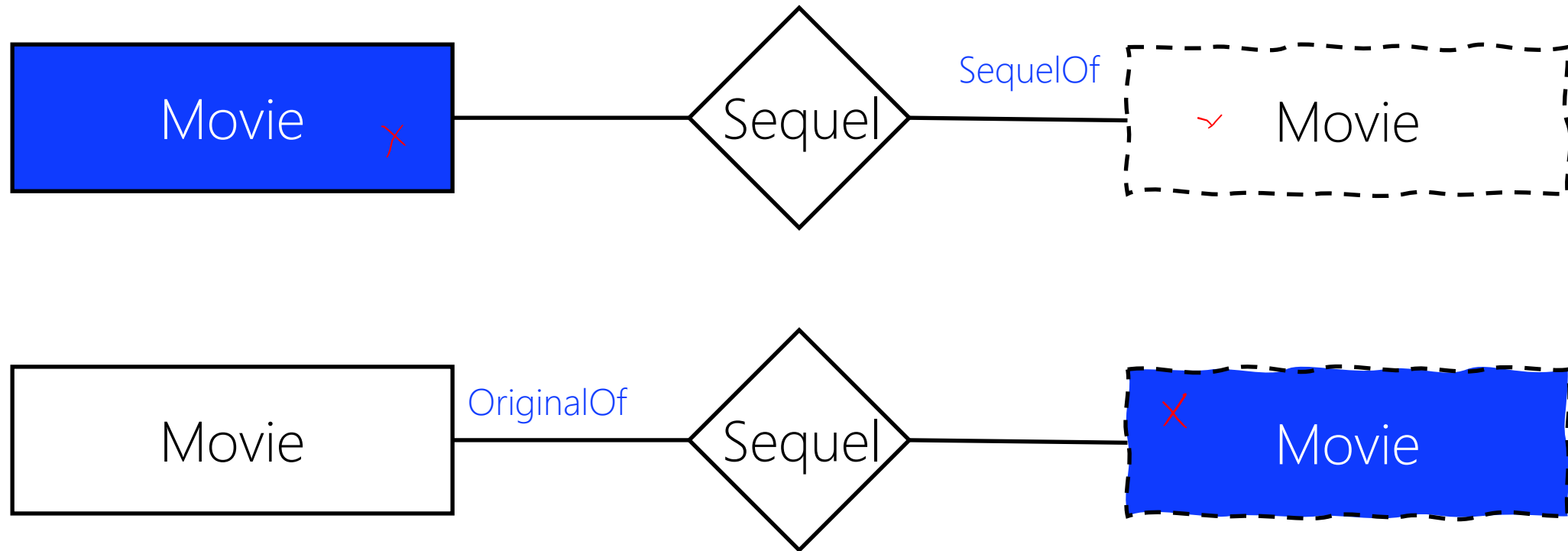
The Matrix
The Matrix Reloaded
The Matrix Revolutions

E/R × Relationship Set × Self (Unary) 27

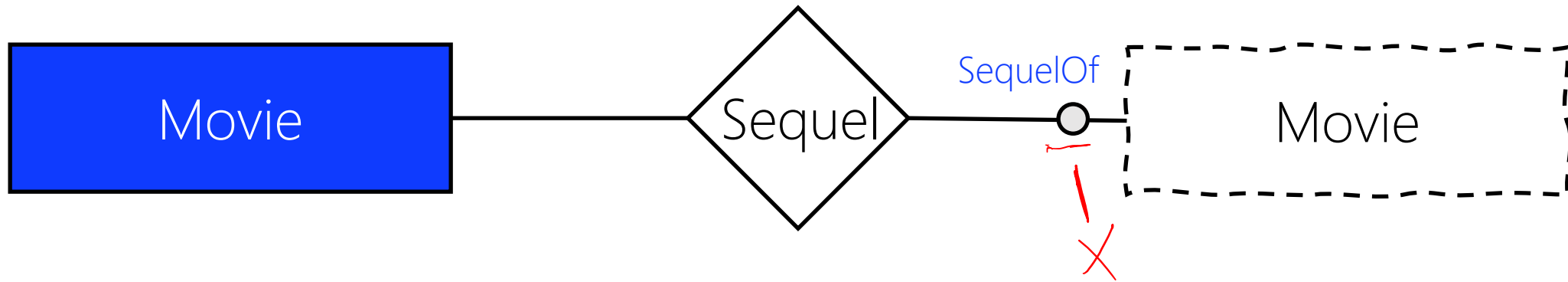


Role?

E/R × Relationship Set × Self (Unary) 28



E/R × Relationship Set × Self (Unary) 29



Participation: Optional | Partial

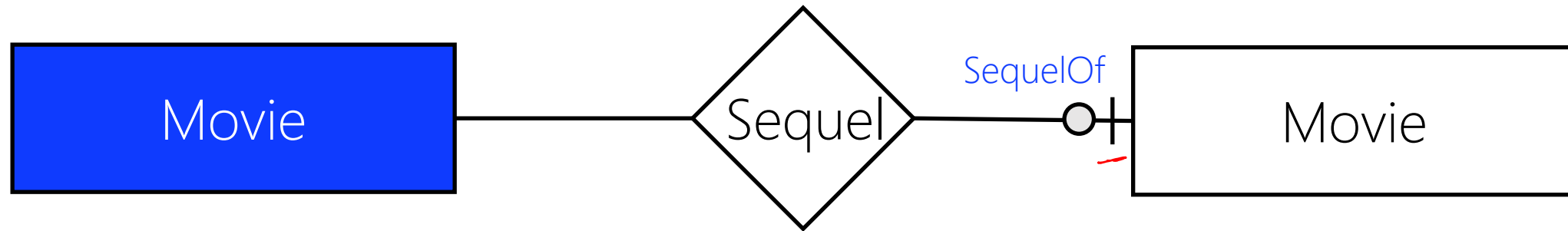
A Movie entity not SequelOf any Movie entity

A Movie entity is SequelOf 0 Movie entity

e.g., 'The Bird', 'The Matrix'!

The Matrix

E/R × Relationship Set × Self (Unary) 30

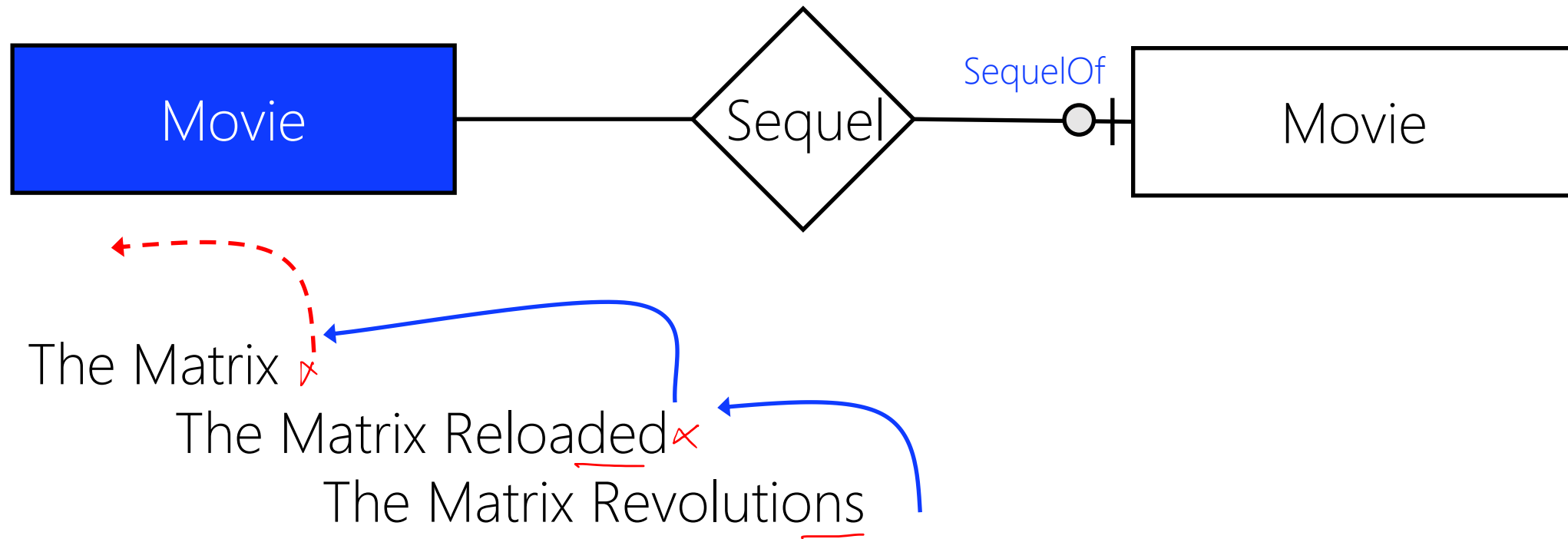


Multiplicity: 1

A Movie entity can be a SequelOf 1 Movie entity at max

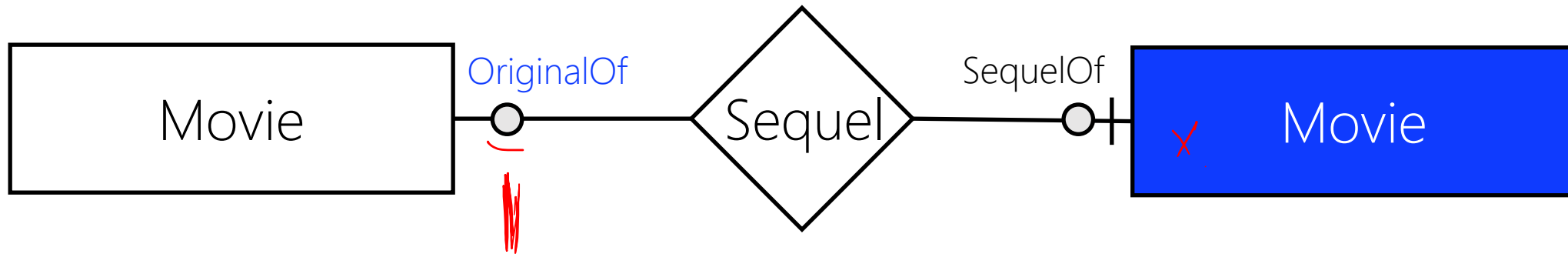
E/R × Relationship Set × Self (Unary)

31



E/R × Relationship Set × Self (Unary)

32

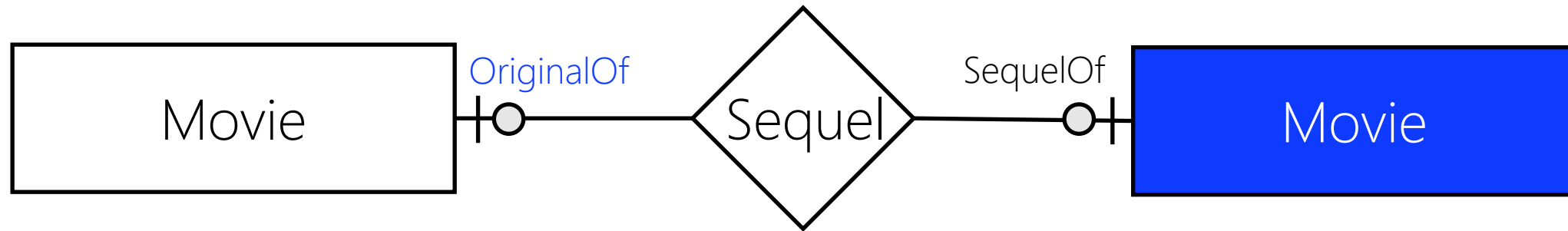


Participation: 1

A Movie entity may not be OriginalOf any sequel
A Movie entity may be OriginalOf 0 Movie entity
e.g., 'The Birds'

E/R × Relationship Set × Self (Unary)

33

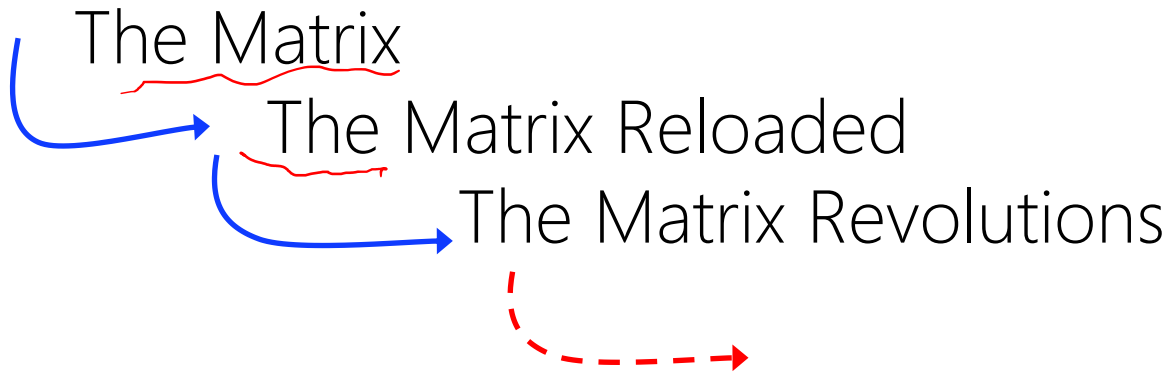
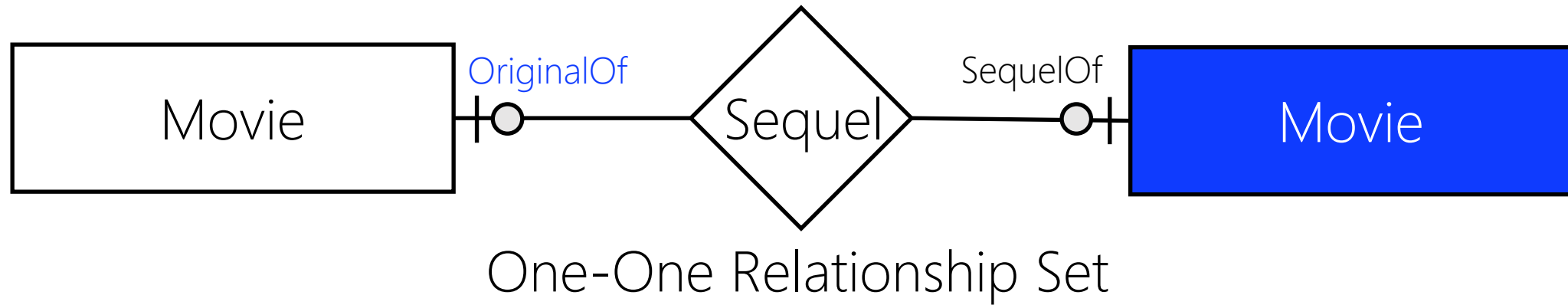


Multiplicity: 1

A Movie entity might be OriginalOf 1 Movie entity at max

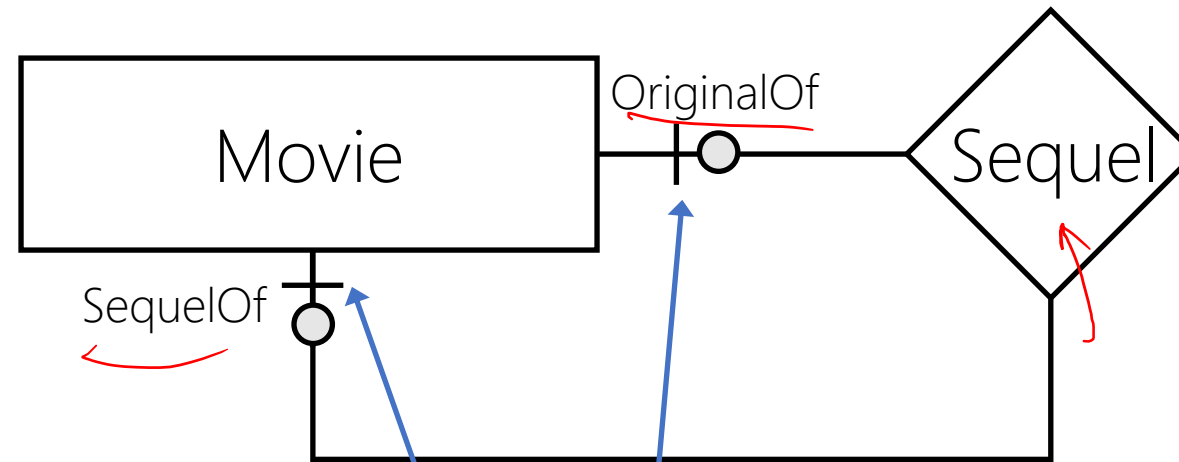
E/R × Relationship Set × Self (Unary)

34



E/R × Relationship Set × Self (Unary)

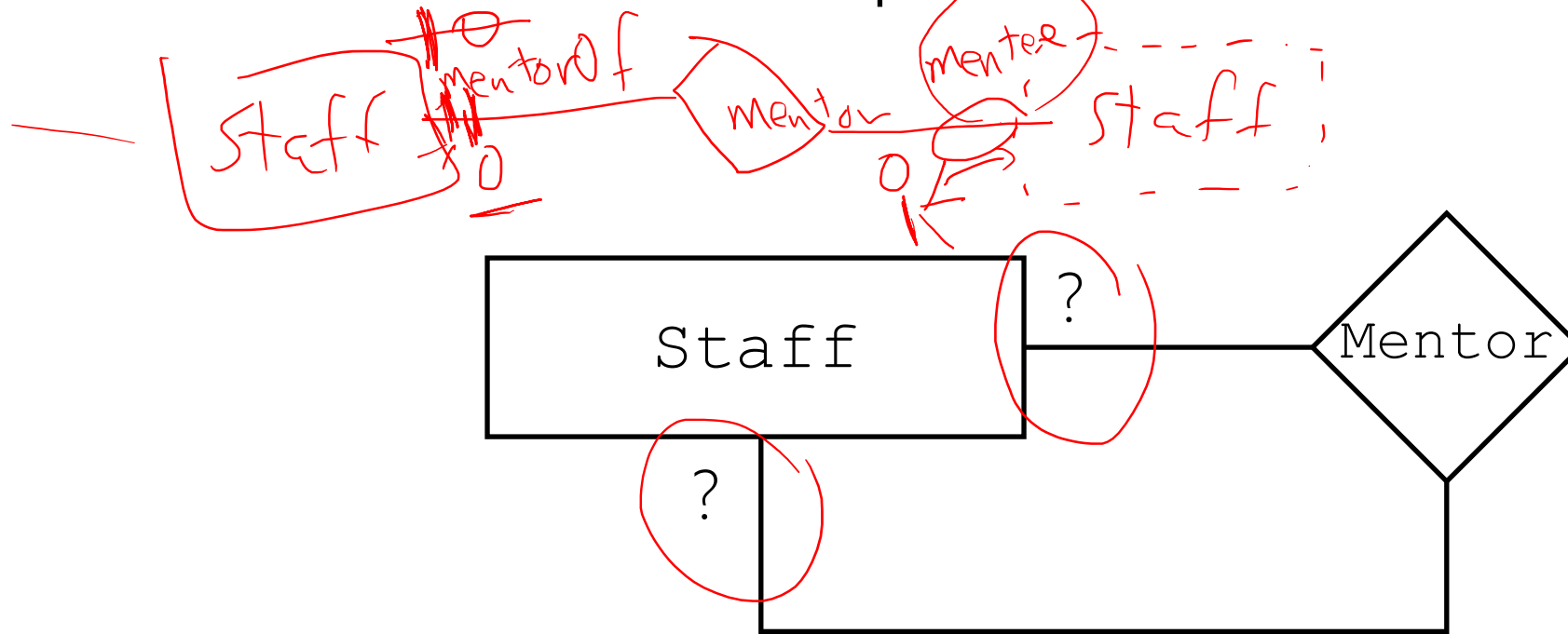
35



Sequel is a One-One Relationship (Set)

E/R × Relationship Set × Self (Unary)

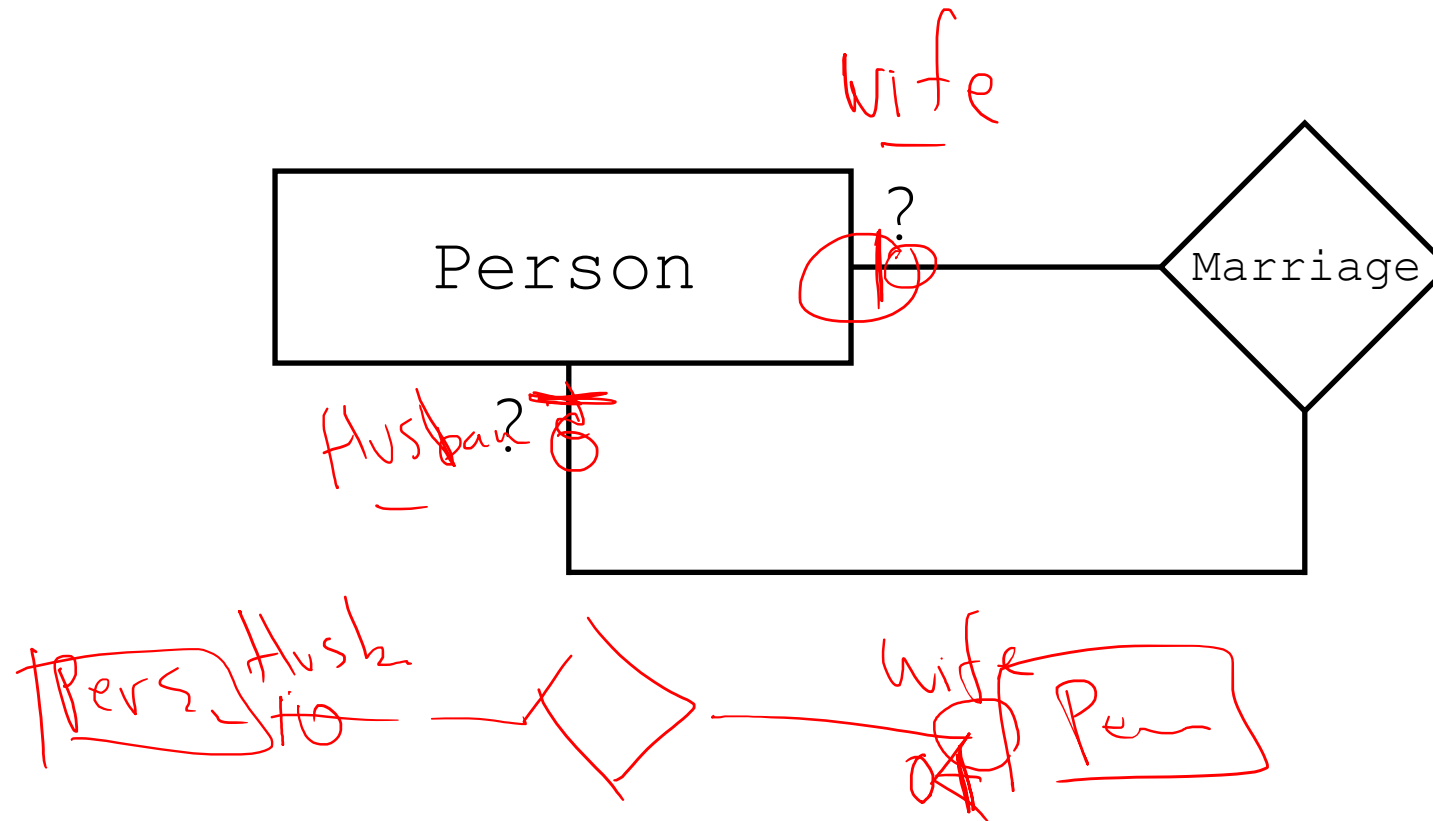
36



Hint: When there is hierarchy between entities in entity set

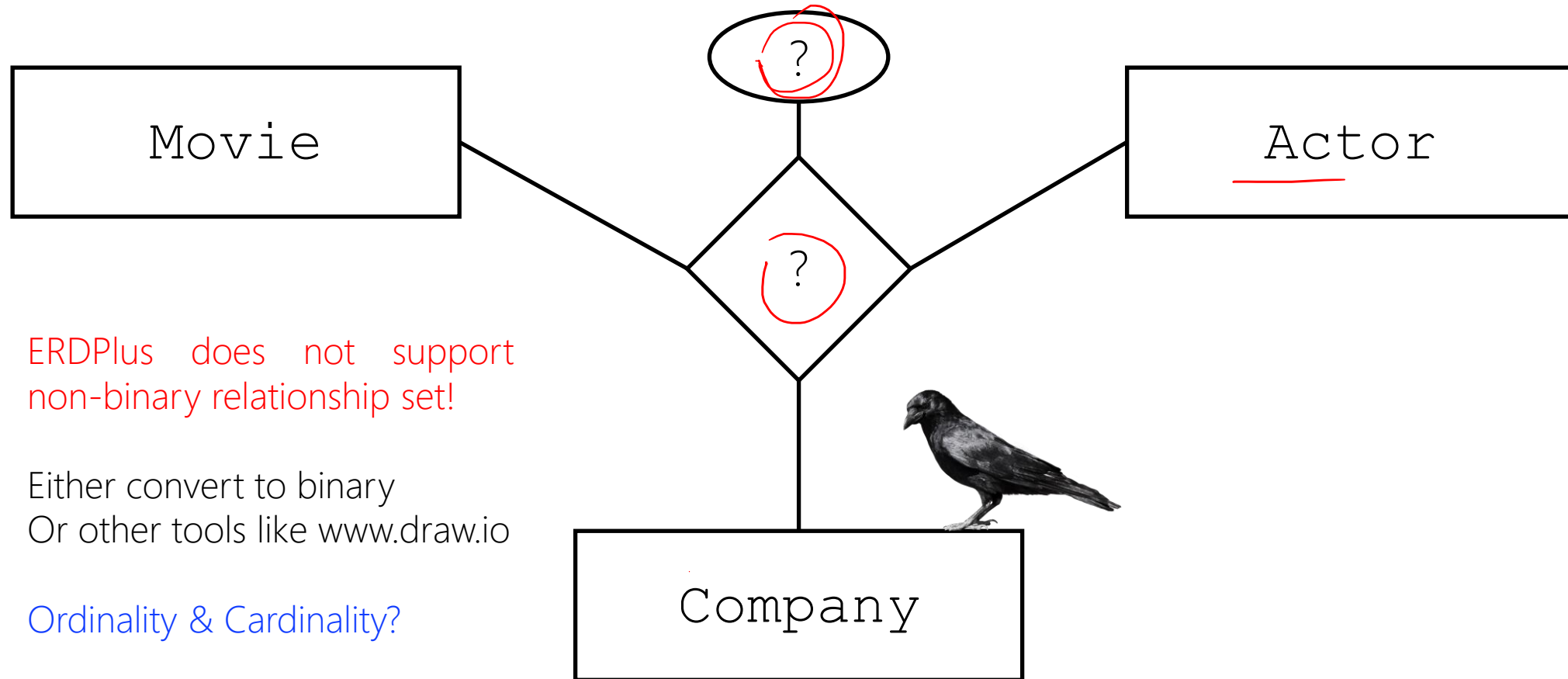
E/R × Relationship Set × Self (Unary)

37



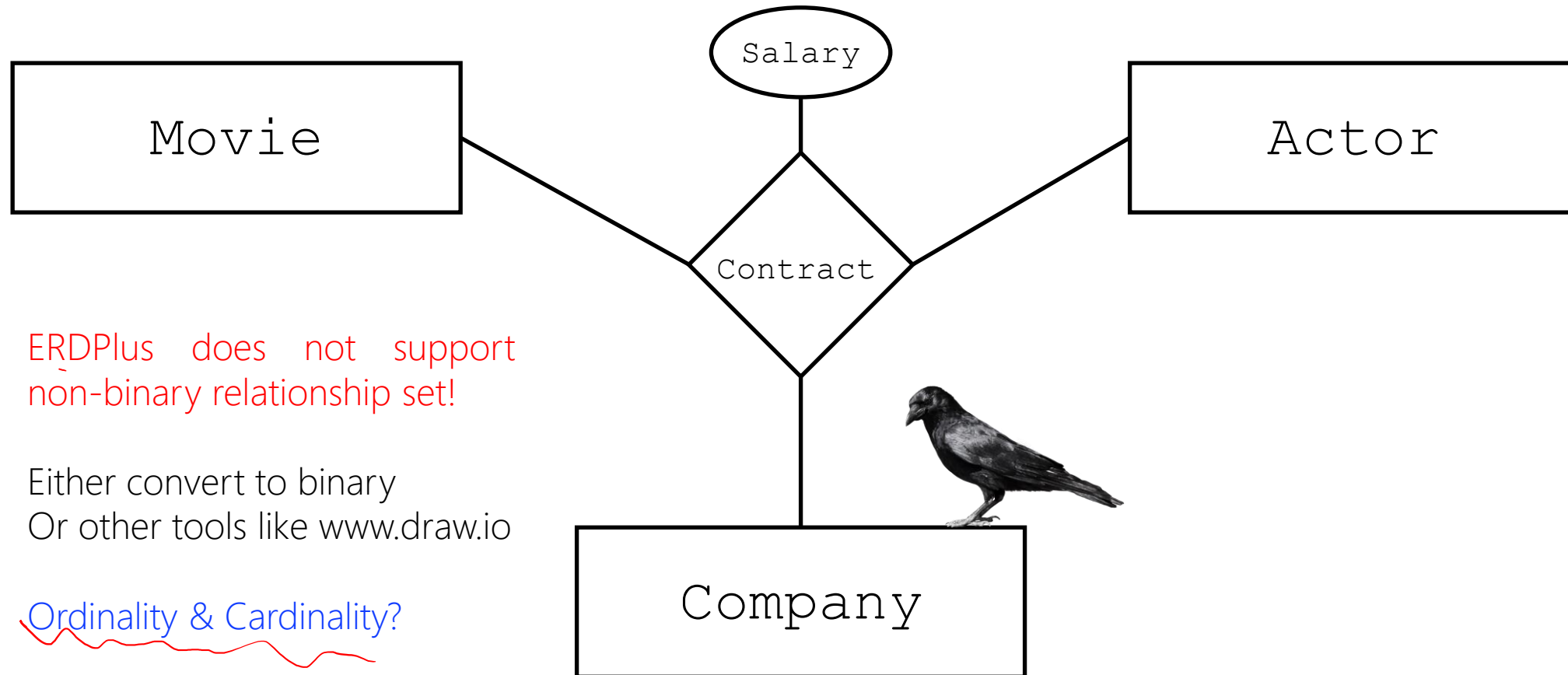
E/R × Ternary Relationship Set

38



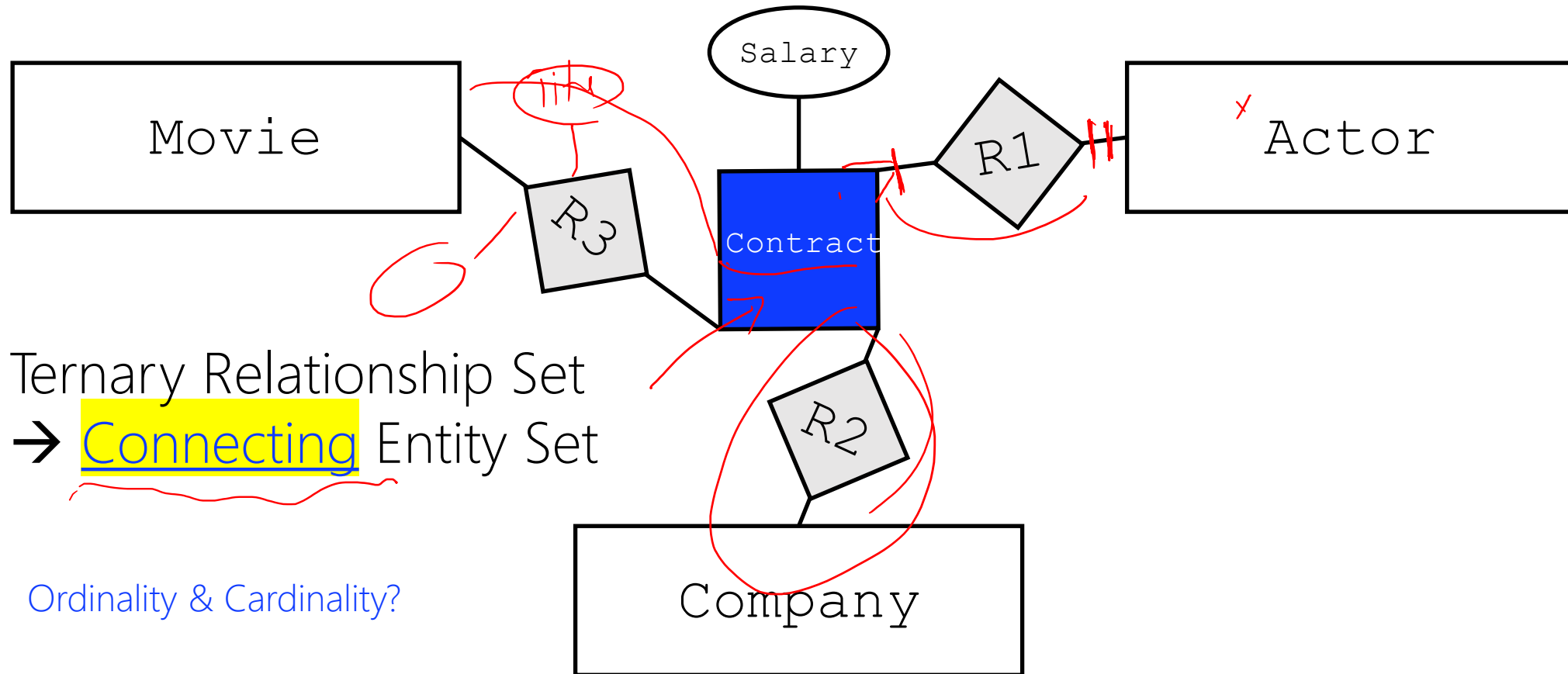
E/R × Ternary Relationship Set

39



E/R × Ternary-2-Binary

40

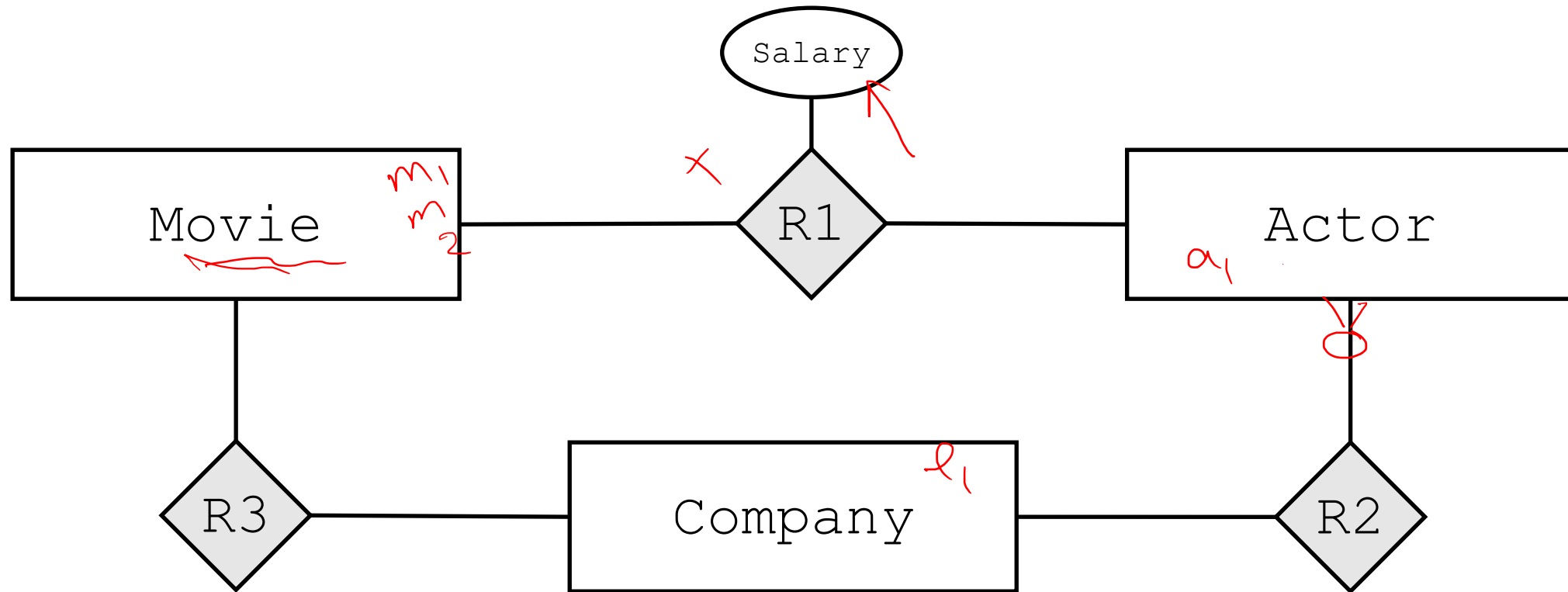


Ternary Relationship Set
→ Connecting Entity Set

Ordinality & Cardinality?

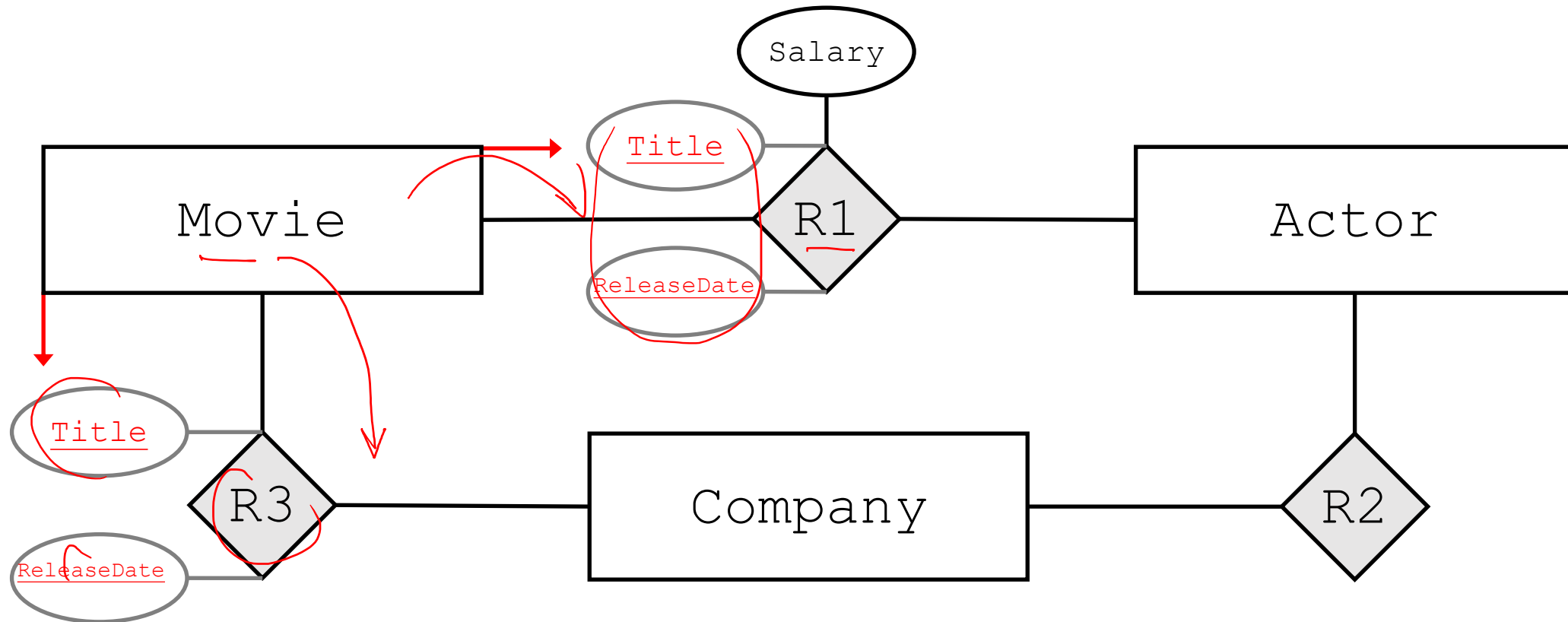
E/R × Circular Relationship Sets

41



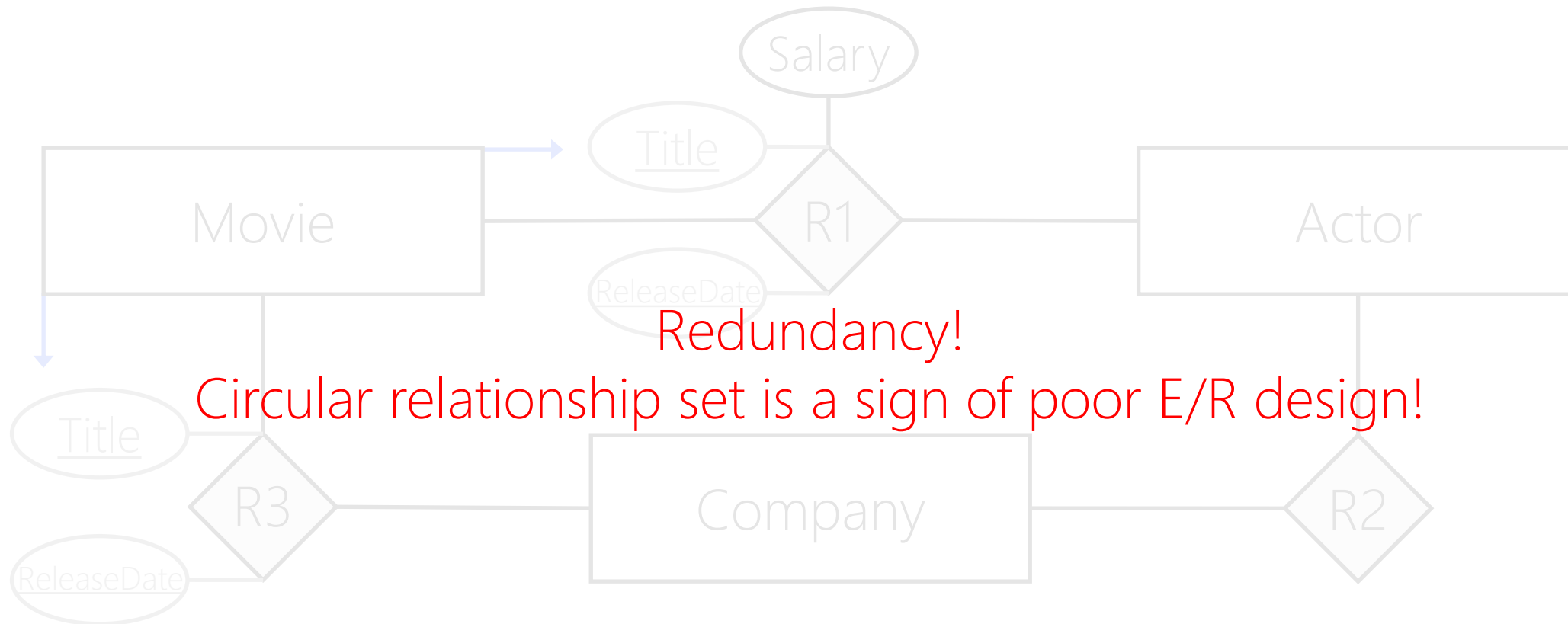
E/R × Circular Relationship Sets

42



E/R × Circular Relationship Sets

43



E/R × Multiway (n-ary) Relationship Set 44

CÉCILE DUFLOT, JEAN-LUC MÉLENCHON, LAURENT BERGER...**Leurs propositions pour un budget plus vert et solidaire** PAGES 6-9**Libération**

زن زندگی آزادی

«FEMME, VIE, LIBERTÉ»

Malgré la répression,
la mobilisation ne faiblit pas
en Iran. Et ce qui était à ses
début un mouvement pour
les droits des femmes tourne
à la révolte contre le régime.

PAGES 2-4

A Téhéran, le 20 septembre. PHOTO SALAMPEX, AFGA

M 00135 - 058 - F - 2,50 €

**Libération**

E/R × Entity Set

46

By definition any entity set MUST have key.

At worst, if there is no key attribute(s), all attributes are in key set.

This guarantees that there is no duplicate entities in entity set.

HOWEVER,

55 King Street West, Suite 700
Kitchener ON N2G 4W1
Phone: (800) 556-1971
Fax: (888) 849-1760

Invoice

*** 20% RESTOCKING FEE ON RETURNED ITEMS***

ALL WARRANTIES ARE MANUFACTURER'S STATED TERMS AND CONDITIONS

NO RETURNS ACCEPTED WITHOUT PRE-AUTHORIZED APPROVAL

Date

5/7/18

Page

1

Invoice Number

IN620995

Due Date

PAID BY CREDIT CARD

Sold To:

HOSSEIN FANI

Ship To:

HOSSEIN FANI

Order No.	Order Date	Customer No.	Salesperson	PO Number	Ship Via	Terms
1805043501	May 4, 2018		PCCANADA			Credit Card

Qty. Ord.	Qty. Shp.	Qty. B/O	Item Number	Description	Unit Price	UOM	Extended Price
1	1	0	CYB-CRA50005	CYBERPOWER CARBON CRA50005 RACK SHELF - 19 1U WIDE X 32.70	90.99	EACH	90.99
			PCFRT	SHIPPING FEE			48.99

Comments:

HST 89527 0213 RT001
QST 1202169020

Tax summary:

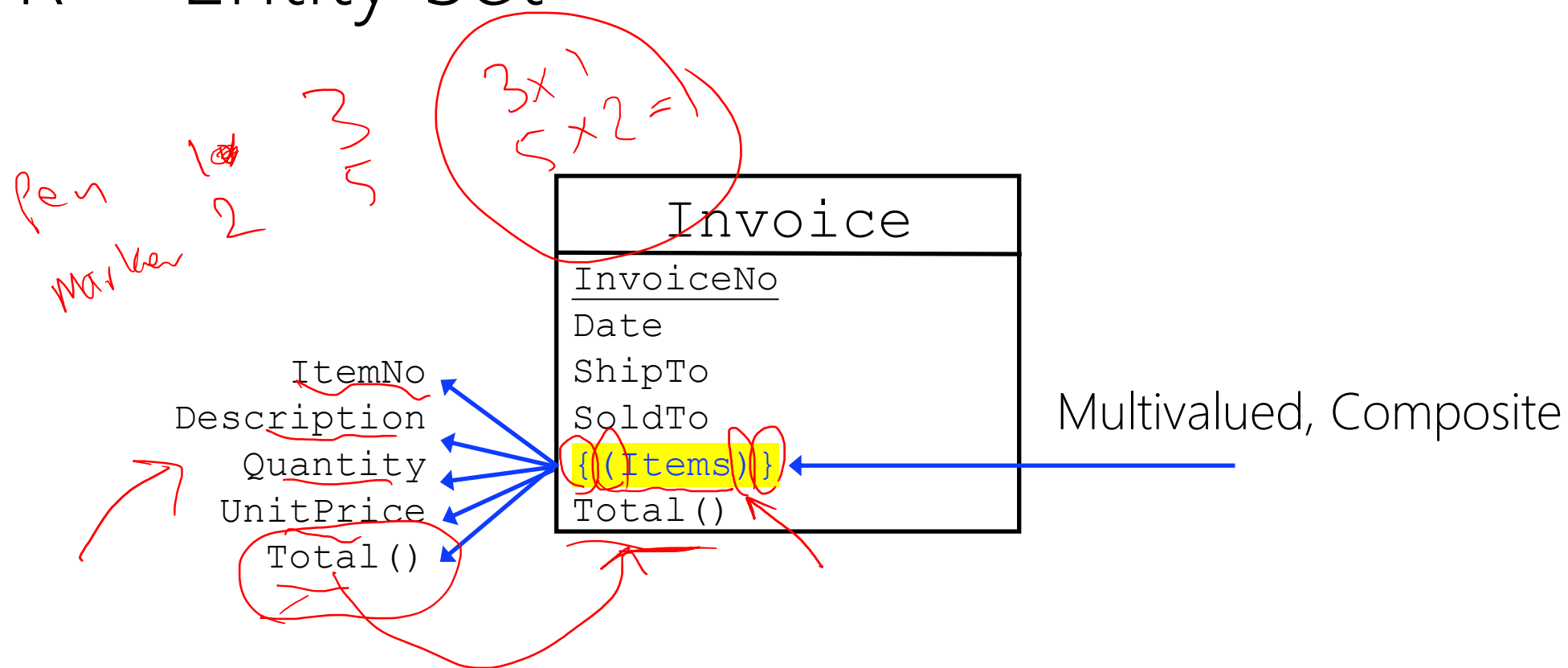
Subtotal

Total sales tax

Total amount

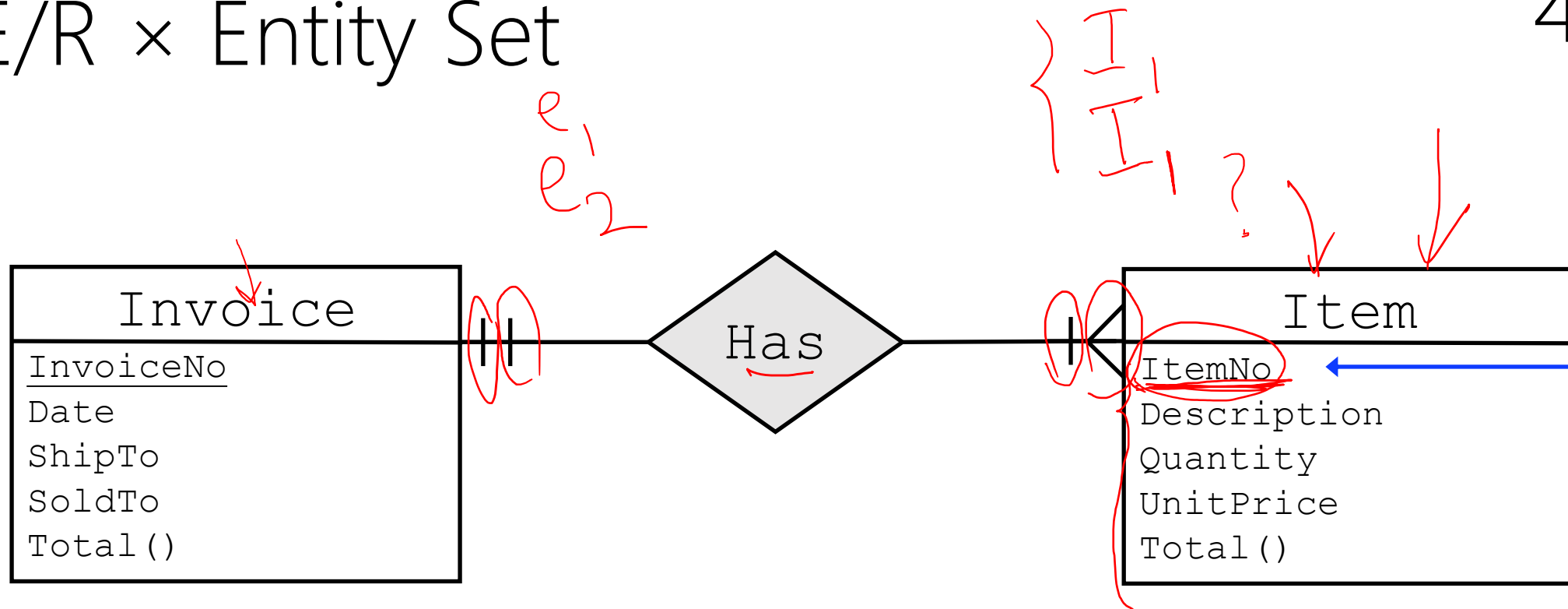
Paid in Full

E/R × Entity Set



E/R × Entity Set

49



55 King Street West, Suite 700
Kitchener ON N2G 4W1
Phone: (800) 556-1971
Fax: (888) 849-1760

Invoice

*** 20% RESTOCKING FEE ON RETURNED ITEMS***

ALL WARRANTIES ARE MANUFACTURER'S STATED TERMS AND CONDITIONS

NO RETURNS ACCEPTED WITHOUT PRE-AUTHORIZED APPROVAL

Date

5/9/18

Page

1

Invoice Number

IN621412

Due Date

PAID BY CREDIT CARD

Sold To:

HOSSEIN FANI

Ship To:

HOSSEIN FANI

Order No.	Order Date	Customer No.	Salesperson	PO Number	Ship Via	Terms
1805091667	May 9, 2018		PCCANADA			Credit Card

Qty. Ord.	Qty. Shp.	Qty. B/O	Item Number	Description	Unit Price	UOM	Extended Price
1	1	0	CYB-CRA50005	CYBERPOWER CARBON CRA50005 RACK SHELF - 19 1U WIDE X 32.70	80 90.99	EACH	90.99
			PCFRT	SHIPPING FEE			48.99

Comments:

HST 89527 0213 RT001
QST 1202169020

Tax summary:

Subtotal

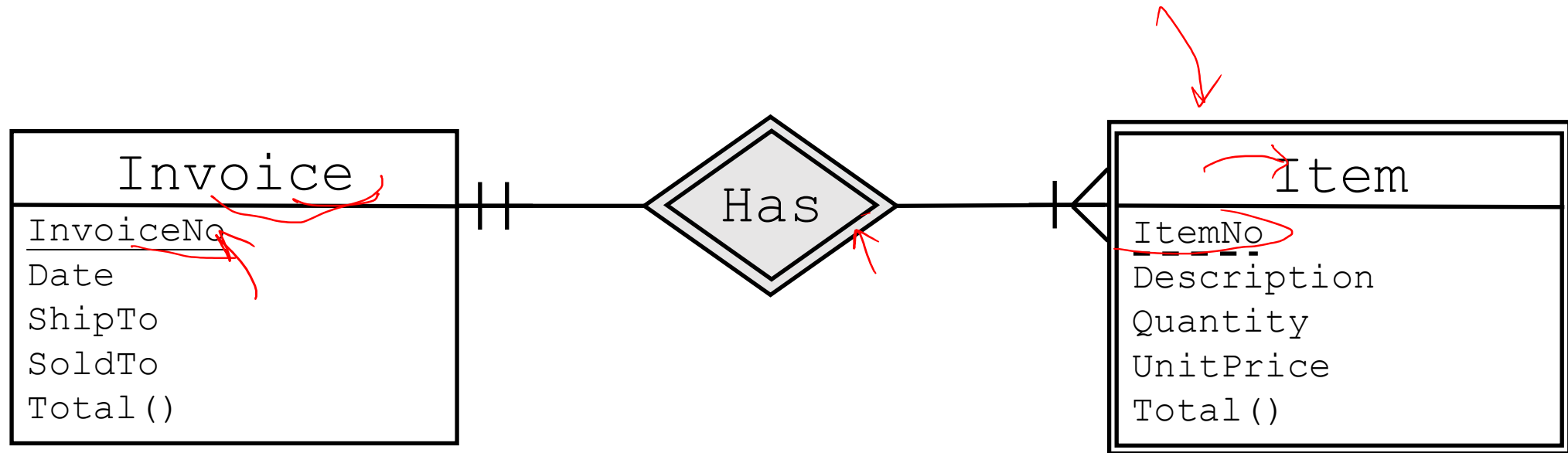
Total sales tax

Total amount

Paid in Full

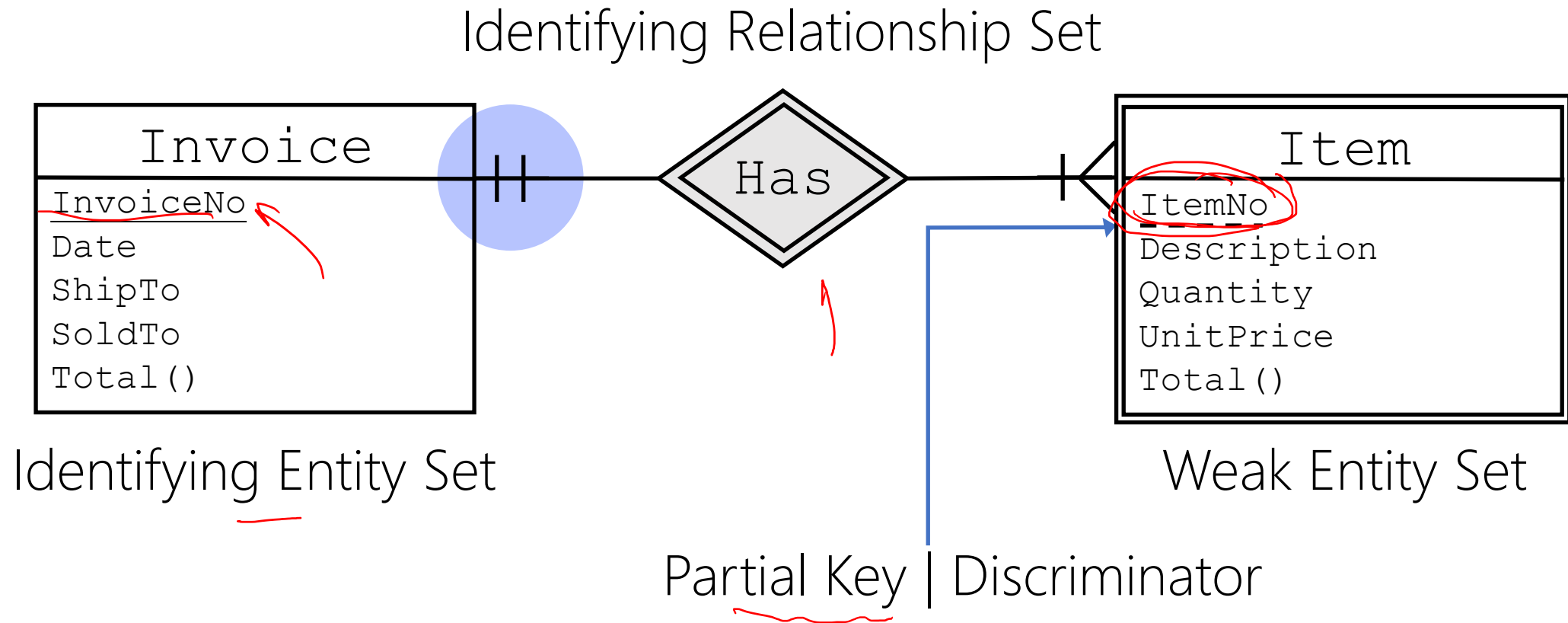
E/R × Weak Entity Set

51



E/R × Weak Entity Set

52



E/R × Weak Entity Set

Weak entity set originally does not have key set

Weak entity set might have partial key set or none

The key set of weak entity set is then:

{key set of identifying entity set} \cup {partial key set if any}

E/R × Weak Entity Set

54

Another example in banking?

Saving
A

20

Page 1
Page 1
Page 3

Page 18
Page 20

Saving
B

Page 1
Page 2
Page 3

Page 20

PAY TO THE ORDER OF _____

DATE 20 _____

_____ \$

100 DOLLARS

HSBC

MEMO _____



⑈001⑈

⑆12345⑈016⑆

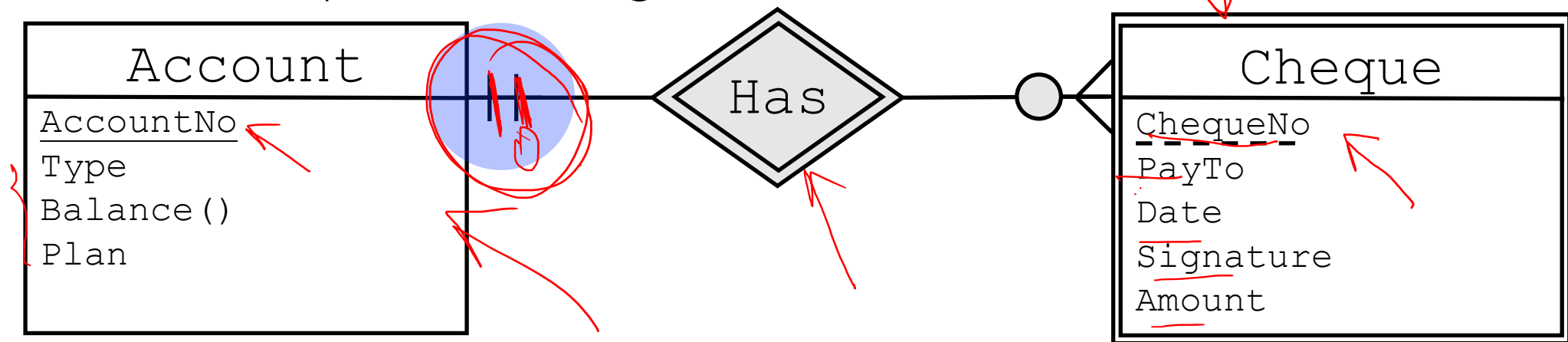


123456⑈789⑈

E/R × Weak Entity Set

56

Another example in banking?



E/R × Design Principles

57

Faithfulness

e.g., entity set | attribute acc. system spec.

Redundancy

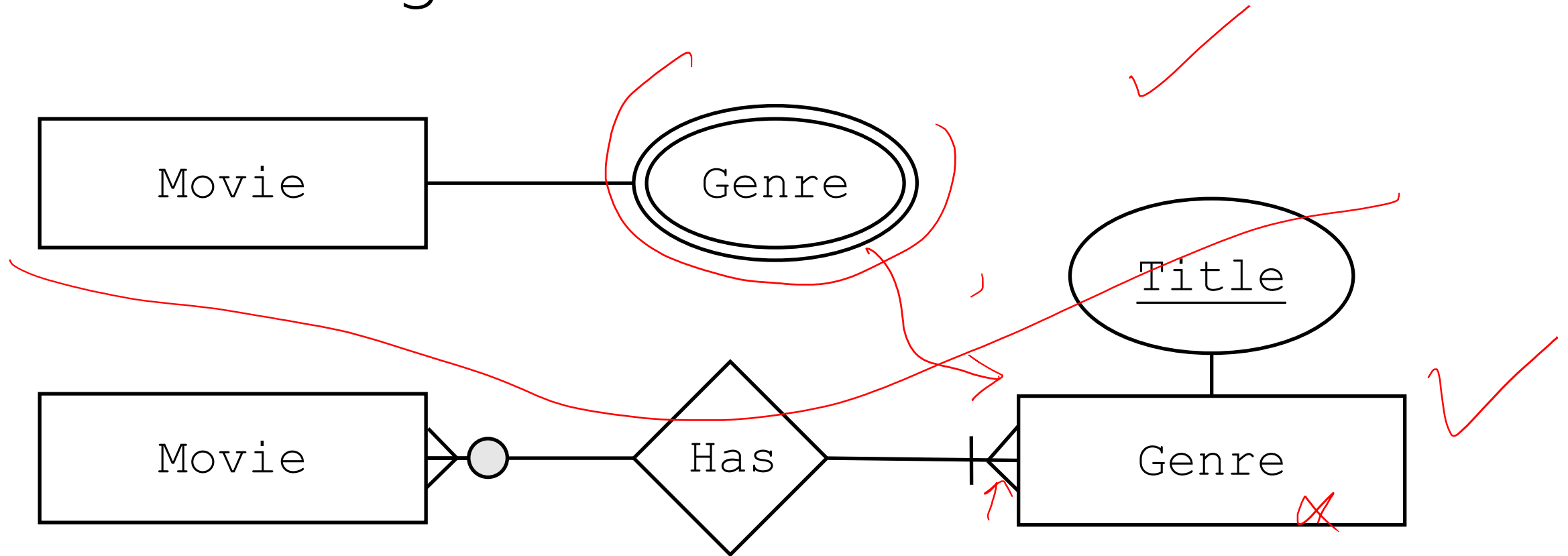
e.g., circular relationship sets

Simplicity

e.g., single attribute key

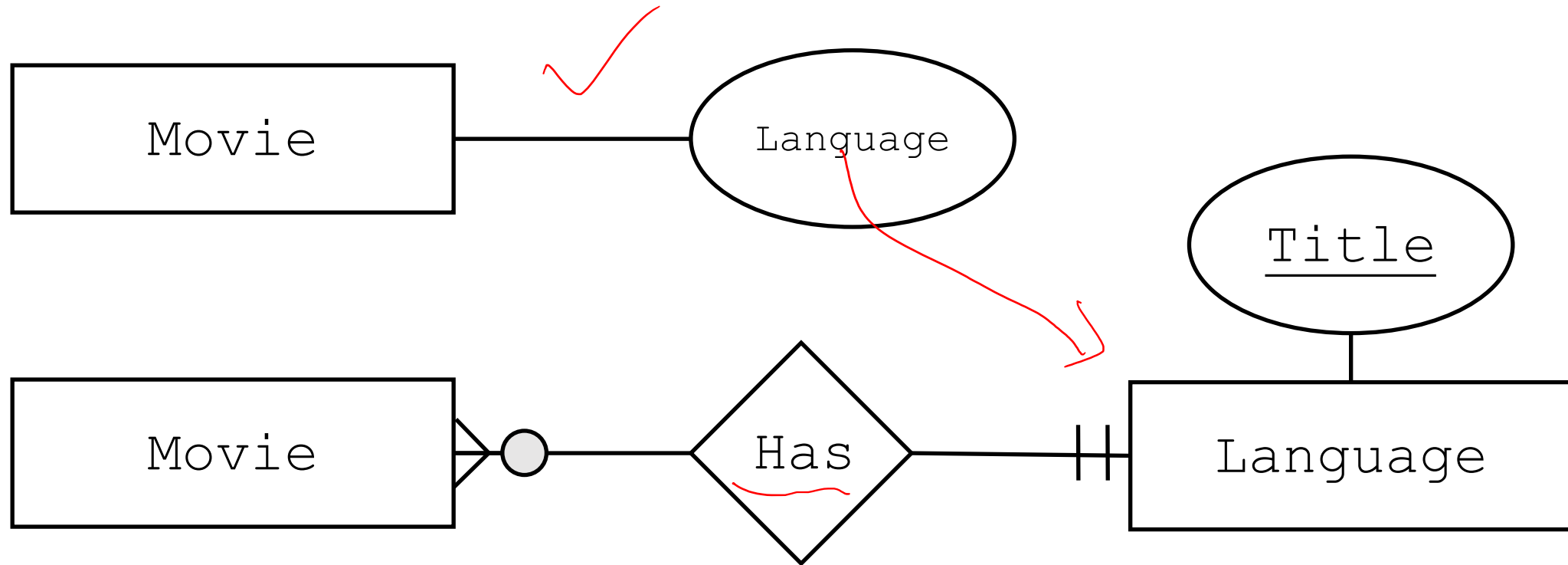
E/R × Design Questions I

58



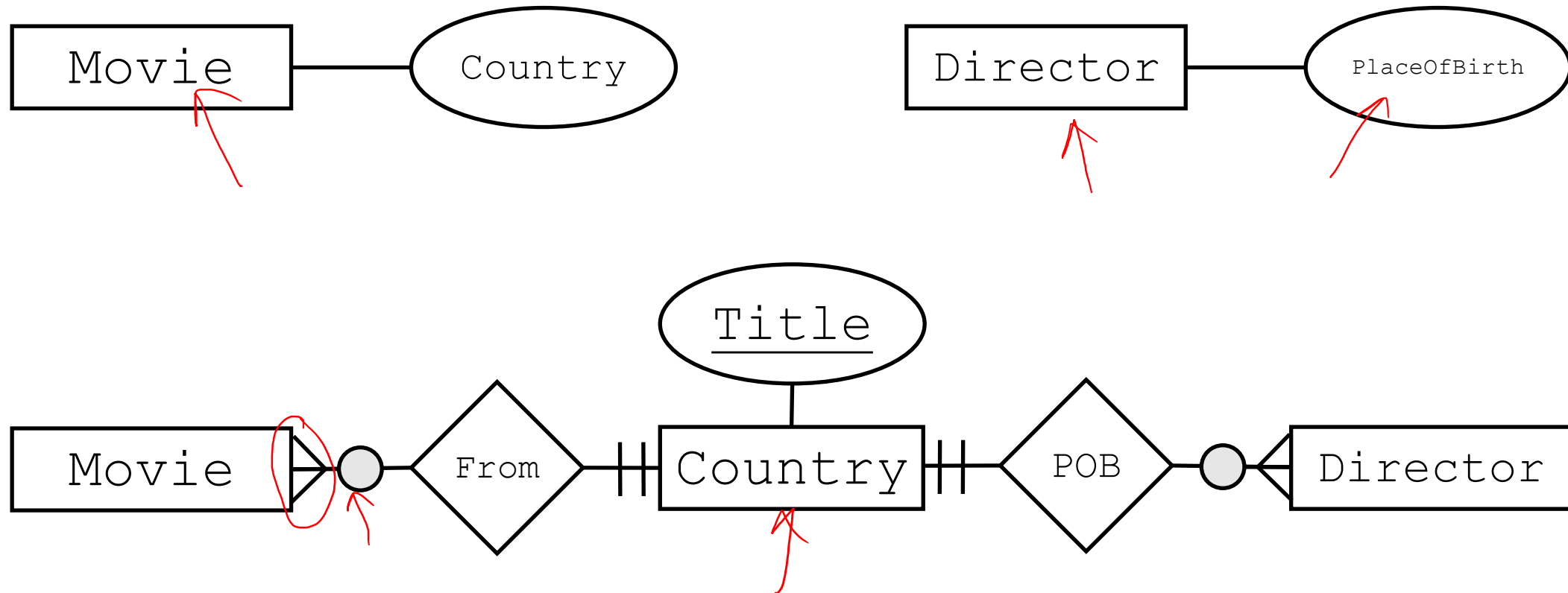
E/R × Design Questions I

59



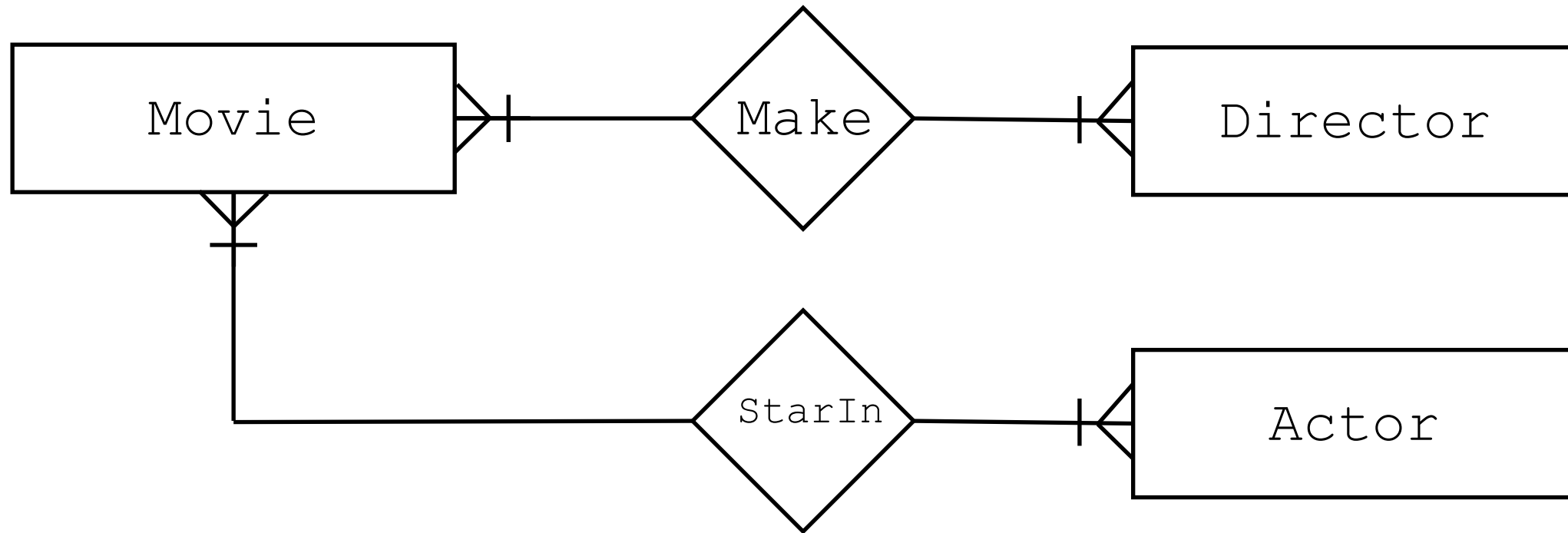
E/R × Design Questions I

60



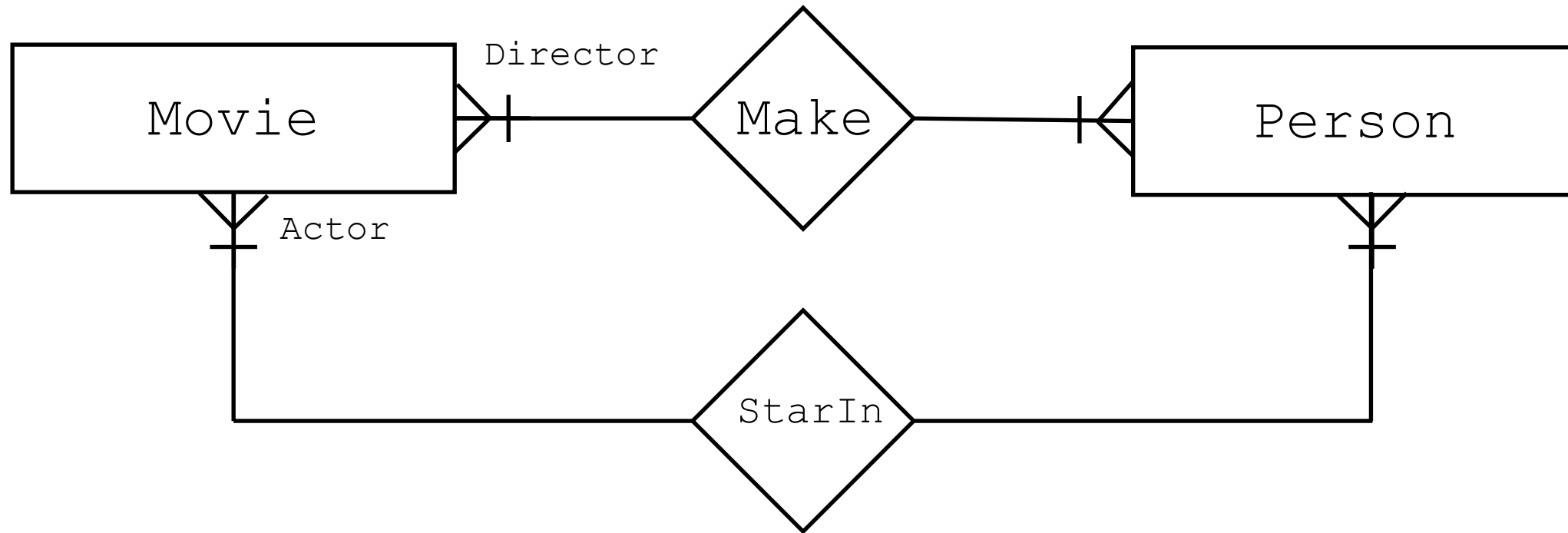
E/R × Design Questions II

61



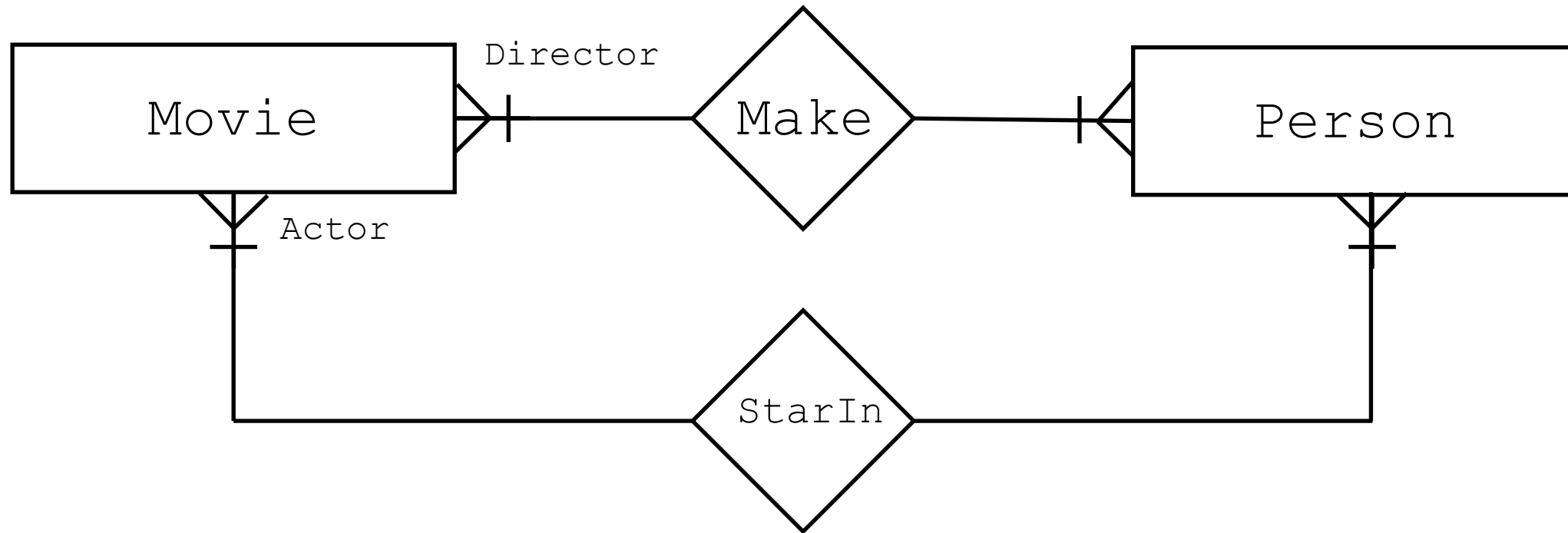
E/R × Design Questions II

62



E/R × Design Questions II

63



Same problem as in Distributor and Producer Companies!

E/R × Design Questions III

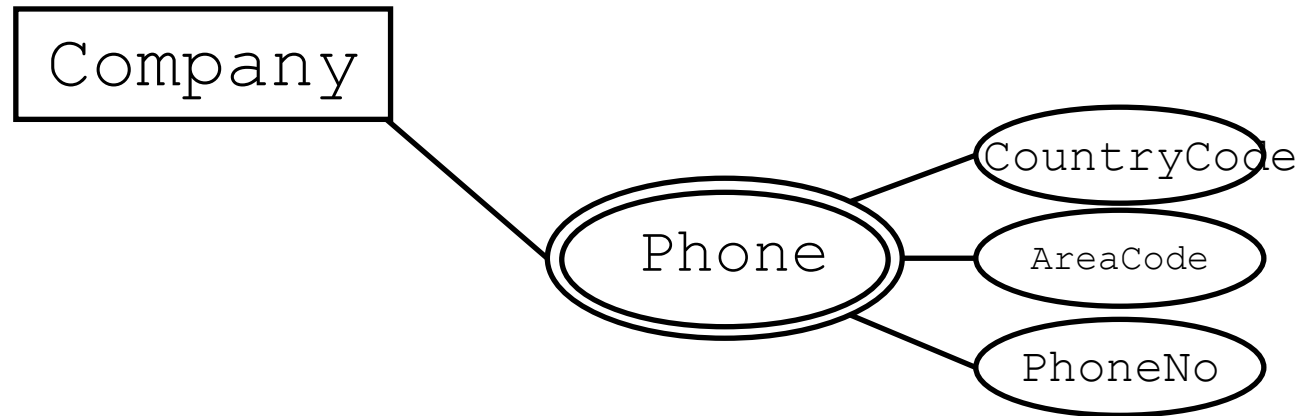
64

Multivalued & Composite Attribute?

E/R × Design Questions III

65

Multivalued & Composite Attribute? Yes.



E/R × Design Questions III

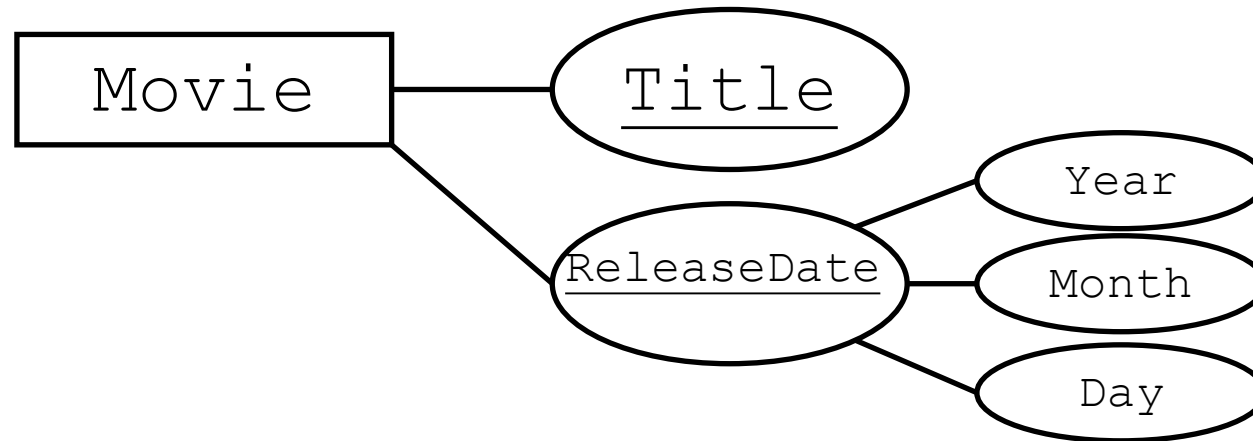
66

Key & Composite?

E/R × Design Questions III

67

Key & Composite? Yes.



E/R × Design Questions III

Multivalued & Composite Attribute? Yes.

Key & Composite? Yes.

Key & Multivalued? No!

Key & Derived?

Derived & Multivalued?

Derived & Composite?

...

