

FUNCTIONAL DEPENDENCIES DATABASE

Functional Dependencies & Normal Forms

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F□□C□□□A□DE□E□DE□CIE□




- - FD
 - FD
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 - -
-

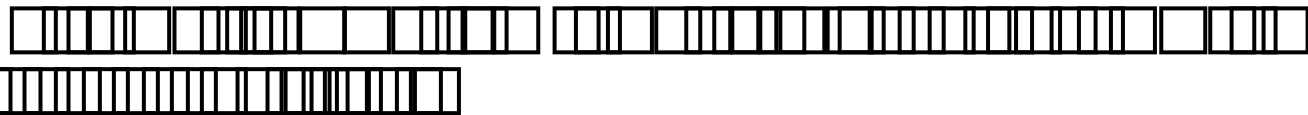
F D

- A  (FD) 

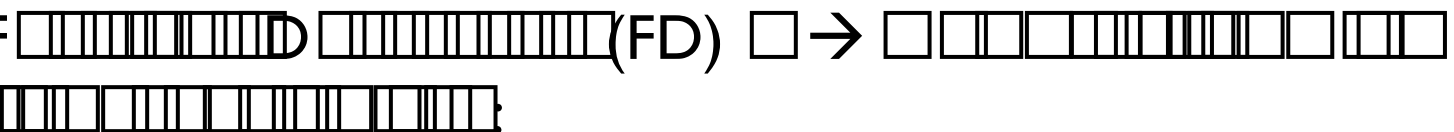
- G ,  
, ,
 ( →) 

-  → 
- C : ; A, B, C, 

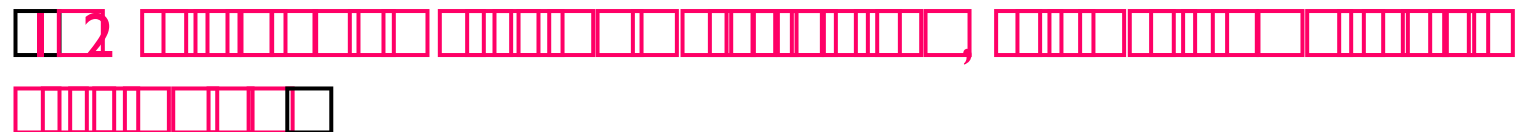
- C : ,  ABC, 


F 

■ C 

■ A 

■ A F 





- $\square \rightarrow A_1 A_2 \square A \square$ $\square \rightarrow A_1$,
 $\square \rightarrow A_2, \square, \square \rightarrow A \square$
- $E \square \square \square \square \square : A \rightarrow BC$ $A \rightarrow B$ $A \rightarrow C$.
-
- FD

FD E

D (, , , B)

■ FD

1. → B

► FD → → B

2. →

FD E

- E FD
() → (, ,)
- E:H FD (EFA)?
() → ()

<i>title</i>	<i>year</i>	<i>length</i>	<i>genre</i>	<i>studioName</i>	<i>starName</i>
Star Wars	1977	124	SciFi	Fox	Carrie Fisher
Star Wars	1977	124	SciFi	Fox	Mark Hamill
Star Wars	1977	124	SciFi	Fox	Harrison Ford
Gone With The Wind	1939	231	drama	MGM	Vivien Leigh
Wayne's World	1992	95	comedy	Paramount	Dana Carvey
Wayne's World	1992	95	comedy	Paramount	Mike Meyers












































































































































































































































































































































G

- (A)
- (A)
- (A)
- (A)

F

- (F)
- (F)
- (F)
- (F)
- (F)



- A  $A_1, A_2, \dots, A_{\square}$                                                         

                                                          

                                                          

                                                          

                                                          

                                  

- E

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Wayne's World	1992	95	comedy	Paramount	Mike Meyers



■ A

■ A

- **E**

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: C

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C

- $\{A_1, A_2, \dots, A_n\}$ is a set of n vectors in \mathbb{R}^m .
- $\{A_1, A_2, \dots, A_n\}$ is a linearly independent set if and only if the only solution to the equation $\sum_{i=1}^n c_i A_i = 0$ is $c_1 = c_2 = \dots = c_n = 0$.
- $C = \{A_1, A_2, \dots, A_n\}$ is a basis for \mathbb{R}^m if and only if C is a linearly independent set and $\text{span}(C) = \mathbb{R}^m$.

E  C 

- $\Sigma(A, B, C, D, E, F)$
- $\Sigma \models \Sigma \rightarrow C, A \rightarrow D, D \rightarrow E, E \rightarrow F \Sigma$
- E 
 $\Sigma^+ = \Sigma, C, D, E, F \Sigma$
- 
 - B  $\Sigma^+ = \Sigma$
 - I :  FD  
 Σ^+ . I  FD  $\rightarrow A$,  A  Σ^+ .

C

A (B C F 7.9 28 I)

■ $A = A_1, \dots, A_n$ $A^+ = A^1, \dots, A^n$

■ $A_1: A_1^1, \dots, A_1^n$ $A_2: A_2^1, \dots, A_2^n$

$A_2: A_2^1, \dots, A_2^n$

$A_3: A_3^1, \dots, A_3^n$ $(A_3^1 \rightarrow A_3^2) A_3^3$ $(A_3^4 \rightarrow A_3^5) A_3^6$ $(A_3^7 \rightarrow A_3^8) A_3^9$

C

A

■ 1: $\{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$

■ 2: $\{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$
 $\{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$
 $B \notin \{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$

■ 3: $\{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$

■ 4: $\{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$
 $\{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$
 $\{A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z\}$

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- 19

- 20

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□□□□A□F□□□□

A 

- C 

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- 


D  **A** :              

D

-
- D
- D : G (A₁, ..., A_n), (B₁, ..., B_n) (C₁, ..., C_n) :
 + A₁, ..., A_n = B₁, ..., B_n C₁, ..., C_n
 + = ∏_{B₁, ..., B_n} (
 + = ∏_{C₁, ..., C_n} (

E

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Wayne's W	1992	Dana Carvey
Wayne's W	1992	Mike Meyers

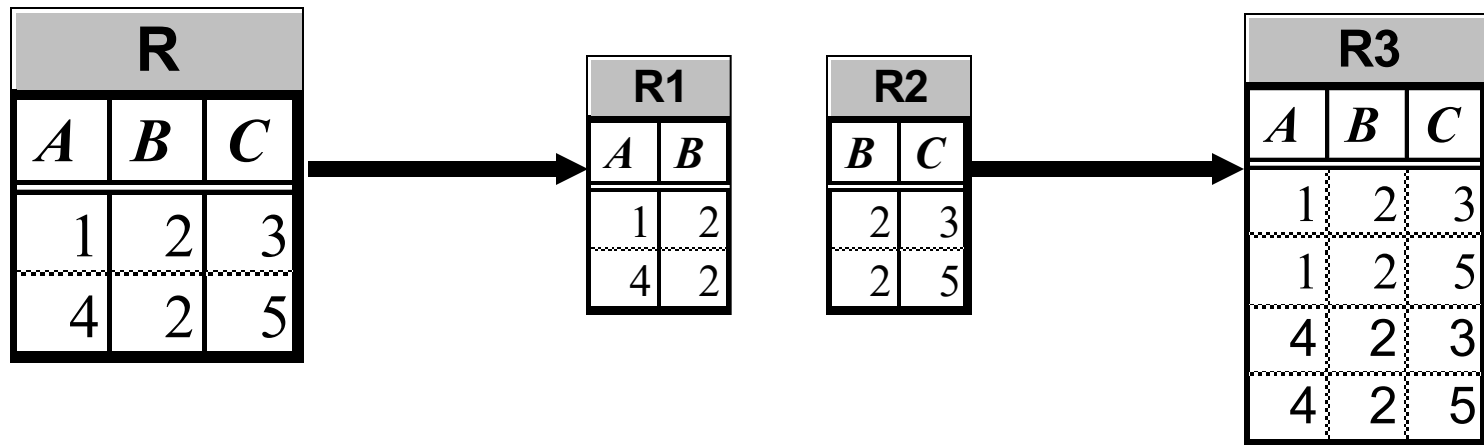
D

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Star Wars	1977	Mark Hamill
Star Wars	1977	Harrison Ford
Gone With	1939	Vivien Leigh
Wayne's W	1992	Dana Carvey
Wayne's W	1992	Mike Meyers

- `SELECT title, year, length, genre, studioName FROM movies WHERE (year > 1970 AND length > 100)`
- `SELECT title, year, length, genre, studioName FROM movies WHERE (year > 1970 AND length > 100 AND genre = 'SciFi')`
- `SELECT title, year, length, genre, studioName FROM movies WHERE (year > 1970 AND length > 100 AND genre = 'SciFi' AND studioName = 'Fox')`

- 29



- (A, B, C) FD $B \rightarrow A$ $B \rightarrow C$
- 2
- $2, 3 = 2$ ($3 < >$)
 \Rightarrow

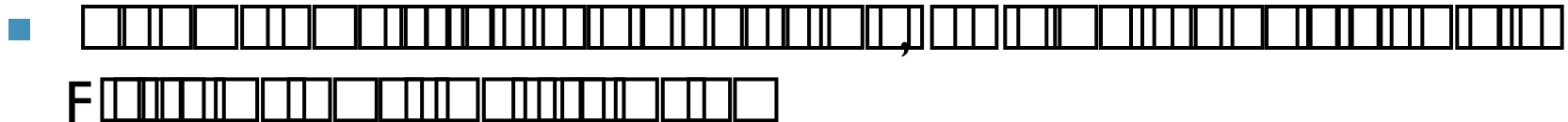
- | item | colors | price | tax |
|------------|-------------|-------|------|
| T-shirt | red, blue | 12.00 | 0.60 |
| polo | red, yellow | 12.00 | 0.60 |
| T-shirt | red, blue | 12.00 | 0.60 |
| sweatshirt | blue, black | 25.00 | 1.25 |

31

1 F

item	colors	price	tax
T-shirt	red, blue	12.00	0.60
polo	red, yellow	12.00	0.60
T-shirt	red, blue	12.00	0.60
sweatshirt	blue, black	25.00	1.25

item	color	price	tax
T-shirt	red	12.00	0.60
T-shirt	blue	12.00	0.60
polo	red	12.00	0.60
polo	yellow	12.00	0.60
sweatshirt	blue	25.00	1.25
sweatshirt	black	25.00	1.25



Data that Contains Non-Alphabetic Characters





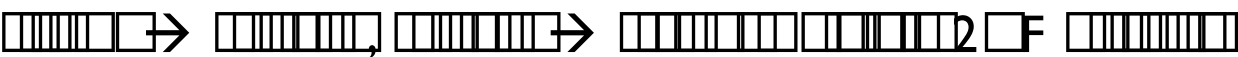
By non-alphabetic characters we mean commas, brackets, parentheses, pipe characters, etc. These act as warning signs that we are dealing with a multi-valued field. However, be careful not to go too far. For instance, if we were designing a solution to hold a block of text, we have probably normalized too much if we have a word entity, a sentence entity, and a paragraph entity. This clue is more applicable to entities that have delimited lists.

Fieldnames with Numbers at the End

As we have noted, an obvious example would be finding entities with *child1*, *child2*, etc., attributes or, my favorite, *UserDefined1*, *UserDefined2*, etc. These are very blatantly wrong.

This is a very common holdover from the days of flat file databases. Multi-table data access was costly, so they put many fields in a single table. This is very detrimental for relational database systems.

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2 F

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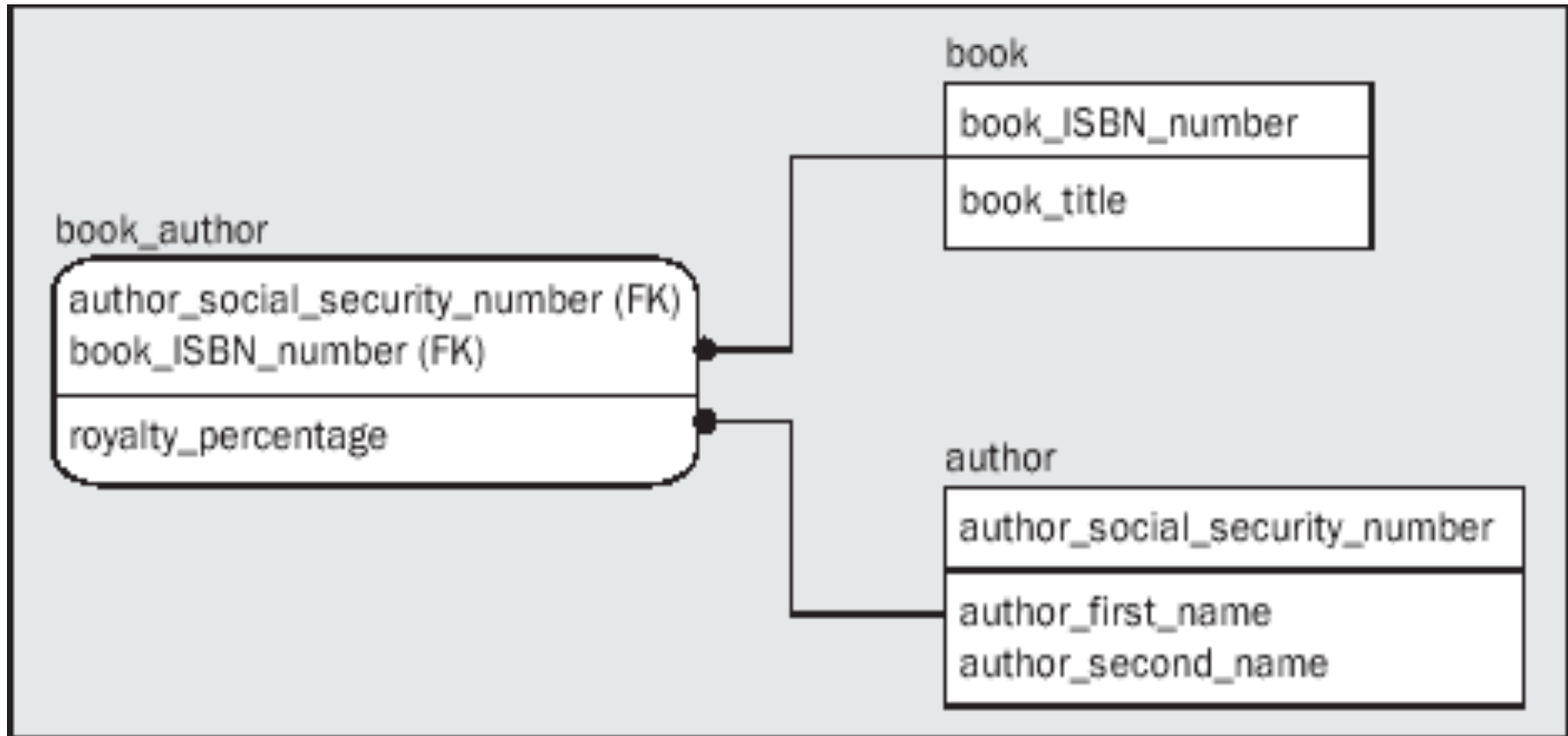
- | item | price |
|------------|-------|
| T-shirt | 12.00 |
| polo | 12.00 |
| sweatshirt | 25.00 |

37

E 4 F

book_author
author_social_security_number book_ISBN_number
royalty_percentage book_title author_first_name author_second_name

A





book

book_ISBN_number

title

price

publisher_name

publisher_city

- 41

- 42

- 43

- 44

- 45