



CS-322 Introduction to database systems

Databases Project - Spring 2022

Team No : 40

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Contents

1	Deliverable 1	1
1.1	Assumptions	1
1.1.1	Story	1
1.1.2	Issue and indicia publisher	1
1.1.3	Series and issue	1
1.1.4	Publisher, brand group and indicia publisher	2
1.2	Entity Relationship Model	3
1.2.1	Schema	3
1.2.2	Description	5
1.3	Relational Model	5
1.3.1	Remarks	10
1.4	Data Cleaning and Transformation Discussion	10
1.5	General Comments	11

List of Figures

1	ER Diagram without attributes	3
2	Entities and relationships with their attributes	4

1 Deliverable 1

The main purpose of this first report is to explain and motivate the choices that has been made while designing an ER model and a corresponding relational schema for the Grand Comics Database (see documentation at docs.comics.org). The studied dataset is available at <https://drive.switch.ch/index.php/s/I8fQKctZc6P0joc>.

1.1 Assumptions

Every assumptions that has been made on the data is motivated by an inspection on the given csv files using Pandas library. All these assumptions are already represented on the ER diagram (see 1) as they are only about participation and key constraints. But for clarity purpose a brief recap is made in the following subsections.

1.1.1 Story

The data contained in the csv file of Story was found to be very dirty thus some assumptions had to be taken on the data. For example, it was observed that some stories does not have an issue id (this has been checked by counting the number of null values for this attribute). However, it can seem logical that a story without an issue can not physically exist. Also the number of story without issue id was clearly negligible and most likely due to dirty data (144 over 1869594 instances). Thus one can assume that a story must have at least one associated issue.

The same phenomenon has been noticed for the type id attribute: 166 over 1869594 instances instances of story table doesn't have any type id. So in the same way one can assume that every story must have at least one type id.

Finally, it is assumed that the issue in which the story was published should be unique.

1.1.2 Issue and indicia publisher

By inspecting the csv file for Issue table, it has been found that some issue does not have a value for the attribute `indicia_publisher_id`, which might also look like a problem, but it has been decided not to assume that it is correlated with dirty data.

However, one can notice that the field `indicia_publisher_id` only contains a number and if the `indicia_publisher_id` exists then it is unique.

1.1.3 Series and issue

There are three different relationship sets involving Series and Issue entity sets.

The first thing is that every issue must be related to an entity from Series that is unique. One can check on the csv file that every issue has actually an existing attribute `series_id` of type `int64`.

The second one is that the series is supposed to have a first and a last issue. It might seem logical to expect that any series have a first issue but maybe not a last. However, some series do not have first and last issue. Actually, they correspond to series that does not have any issue.

1.1.4 Publisher, brand group and indicia publisher

Every brand group from the csv file has an existing publisher_id and therefore is owned by a master publisher. However, Brand group is not declared as a weak entity because one can for example imagine that a brand group can change from one publisher to another. In fact, it is logical to declare brand group as an independent entity set.

It also has been checked that every indicia publisher has a publisher_id, and because Indicia_publisher has a different role from publisher it was natural not to declare it as a weak entity. Finally it is assumed that a brand group or an indicia publisher must have one master publisher.

1.2 Entity Relationship Model

1.2.1 Schema

Figure 1 shows the proposed ER diagram for the Grand Comics Database. In order to keep the ER diagram readable it has been chosen to show only the entities and the relationship first, the attributes of each entities are given in Figure 2. Section 1.2.2 describes the nomenclature used.

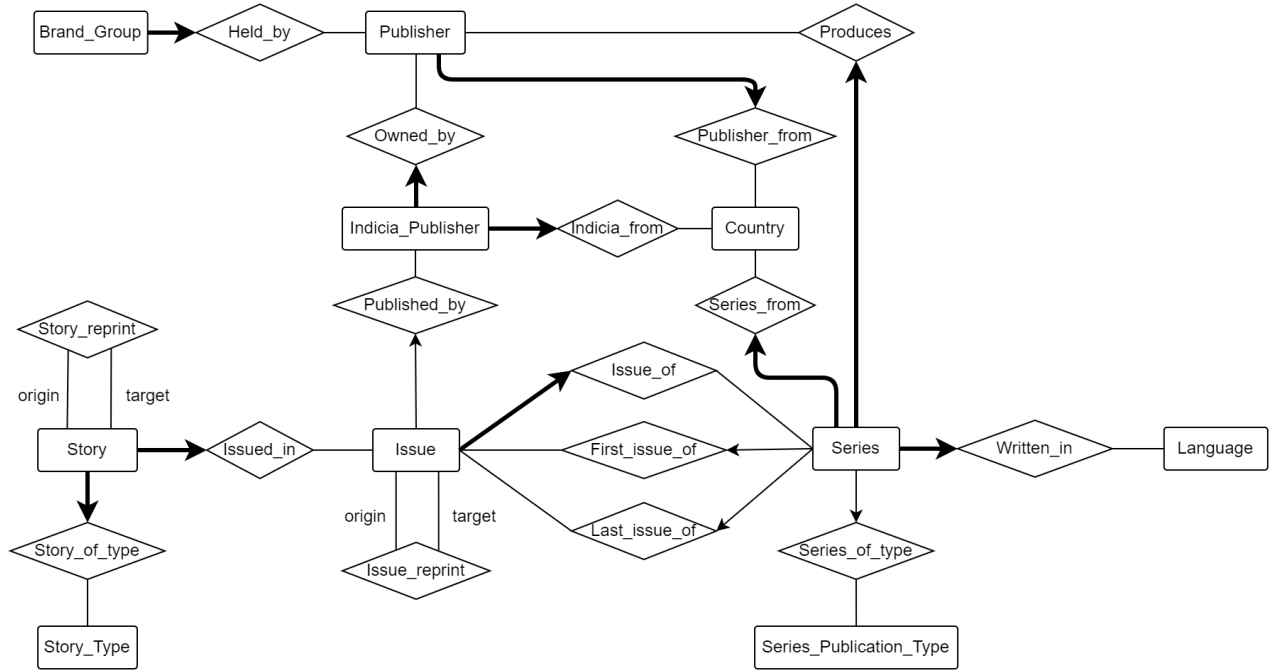


Figure 1: ER Diagram without attributes

<table><tr><td>Story</td></tr><tr><td><u>sid</u></td></tr><tr><td>title</td></tr><tr><td>feature</td></tr><tr><td>issue_id</td></tr><tr><td>script</td></tr><tr><td>pencils</td></tr><tr><td>inks</td></tr><tr><td>colors</td></tr><tr><td>letters</td></tr><tr><td>editing</td></tr><tr><td>genre</td></tr><tr><td>characters</td></tr><tr><td>synopsis</td></tr><tr><td>reprint_notes</td></tr><tr><td>notes</td></tr><tr><td>type_id</td></tr></table>	Story	<u>sid</u>	title	feature	issue_id	script	pencils	inks	colors	letters	editing	genre	characters	synopsis	reprint_notes	notes	type_id	<table><tr><td>Issue</td></tr><tr><td><u>iid</u></td></tr><tr><td>number</td></tr><tr><td>series_id</td></tr><tr><td>indicia_publisher_id</td></tr><tr><td>publication_date</td></tr><tr><td>price</td></tr><tr><td>page_count</td></tr><tr><td>indicia_frequency</td></tr><tr><td>editing</td></tr><tr><td>notes</td></tr><tr><td>isbn</td></tr><tr><td>valid_isbn</td></tr><tr><td>barcode</td></tr><tr><td>title</td></tr><tr><td>on_sale_date</td></tr><tr><td>rating</td></tr></table>	Issue	<u>iid</u>	number	series_id	indicia_publisher_id	publication_date	price	page_count	indicia_frequency	editing	notes	isbn	valid_isbn	barcode	title	on_sale_date	rating	<table><tr><td>Series</td></tr><tr><td><u>seid</u></td></tr><tr><td>name</td></tr><tr><td>format</td></tr><tr><td>year_began</td></tr><tr><td>year_ended</td></tr><tr><td>publication_dates</td></tr><tr><td>first_issue_id</td></tr><tr><td>last_issue_id</td></tr><tr><td>publisher_id</td></tr><tr><td>country_id</td></tr><tr><td>language_id</td></tr><tr><td>notes</td></tr><tr><td>color</td></tr><tr><td>dimensions</td></tr><tr><td>paper_stock</td></tr><tr><td>binding</td></tr><tr><td>publishing_format</td></tr><tr><td>publication_type_id</td></tr></table>	Series	<u>seid</u>	name	format	year_began	year_ended	publication_dates	first_issue_id	last_issue_id	publisher_id	country_id	language_id	notes	color	dimensions	paper_stock	binding	publishing_format	publication_type_id	<table><tr><td>Indicia_Publisher</td></tr><tr><td><u>ipid</u></td></tr><tr><td>name</td></tr><tr><td>publisher_id</td></tr><tr><td>country_id</td></tr><tr><td>year_began</td></tr><tr><td>year_ended</td></tr><tr><td>is_surrogate</td></tr><tr><td>notes</td></tr><tr><td>url</td></tr></table> <table><tr><td>Publisher</td></tr><tr><td><u>pid</u></td></tr><tr><td>name</td></tr><tr><td>country_id</td></tr><tr><td>year_began</td></tr><tr><td>year_ended</td></tr><tr><td>notes</td></tr><tr><td>url</td></tr></table> <table><tr><td>Brand_Group</td></tr><tr><td><u>bgid</u></td></tr><tr><td>name</td></tr><tr><td>year_began</td></tr><tr><td>year_ended</td></tr><tr><td>notes</td></tr><tr><td>url</td></tr><tr><td>publisher_id</td></tr></table>	Indicia_Publisher	<u>ipid</u>	name	publisher_id	country_id	year_began	year_ended	is_surrogate	notes	url	Publisher	<u>pid</u>	name	country_id	year_began	year_ended	notes	url	Brand_Group	<u>bgid</u>	name	year_began	year_ended	notes	url	publisher_id
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Figure 2: Entities and relationships with their attributes

1.2.2 Description

The nomenclature used to create the ER diagram is taken from [1] where key constraints and participation constraints are well defined in section 2.4 of this book. Here is the most useful information:

- Entity sets are represented by a rectangle shape.
- Relationship sets are represented by a diamond shape.
- Primary key are underlined in Figure 2.
- When two entities are involved in a relationship and that the first entity has a relation with at most one instance of the second entity, then the branch bound to the first entity is replaced with an arrow pointing toward the relationship.
- If the participation of the entity is total (it has a relation with exactly one instance of the second entity), the arrow is bold.

For *Story_reprint* and *Issue_reprint* it has be decided to keep the id as an attributes even though one could drop it (actually we were not sure if we could drop some unnecessary attributes from the given csv files so we kept it).

1.3 Relational Model

In order to avoid redundancy and to not overload the report the relational model is directly given in DDL where the resulting tables, keys, foreign keys, constraints, type, domain constraints and nullable values are explicitly defined. Here are the most useful informations about the proposed DDL :

- Domain constraints are expressed by defining a type for the attributes (built-in types compatible with Oracle).
- Relationships are defined using foreign key in the relevant entity sets as explained in the following paragraph. The name given to these kind of constraints corresponds to the name of the relationship sets in the ER diagram.
- Participation constraints are defined using NOT NULL clause. Primary key has to be NOT NULL as well.
- The size is not specified for INTEGER type as the default size is large enough for the GCD dataset.
- VARCHAR2 type as been preferred than CHAR type as it offers more flexibility by using dynamic allocation memory.

- When specified the size of a VARCHAR2 is expressed in bytes.
- When an attribute can contain an arbitrary long string the size is not specified.
- When the size is known to be small then the size is set by overestimating the max size found in the csv file for the given attributes (assuming that the strings is encoded in utf8).
- When the size is known to be limited but not small the most common length VARCHAR(255) is used since it's large enough and it's the maximum value encoded in 8 bits.
- There is no weak entity (instances of every entity sets can exist by itself) thus for foreign key constraint with total participation noting is specified as ON DELETE NO ACTION and ON UPDATE NO ACTION is already here by default.
- When a foreign key can be null (no total participation) ON DELETE SET NULL is specified.

It is important to mention that in the following relational model, except for *Story_reprint* and *Issue_reprint*, the relationship sets represented in the ER diagram are not translated in the relational model by a table. The relationships set are indeed translated by including the information about the relationship set in the table corresponding to the entity set with the key. For instance, instead of creating a table for the relationship *Held_by* with a foreign key *brand_group_id* from *Brand_group* entity set and foreign key *publisher_id* from *Publisher* entity set, knowing that every instance of *Brand_group* has at most one associated instance of *Publisher* one could simply add an attribute *publisher_id* as a foreign key to *Brand_group*.

This is possible since every relationship sets in the ER model involves at least one entity set which has a key constraint specifying that every instance of it is in relation with at most one instance of the other entity set. This approach has been preferred as none of the relationship set have specific attributes and also this approach avoids creating a distinct table for every relationship set. The only cons of this method is that some space could be wasted if for example several instances of *Brand_group* do not have a *publisher_id* as with this approach one has to store null value for these instances. In the proposed ER model most of the relationships include one entity set with total participation thus this drawback does not apply. For the relationship with partial participation it still has been chosen to use the same approach since it offers faster operations (joining table is time-consuming).

DDL

```

01 | CREATE TABLE 'Story' (
02 |     'sid' INTEGER NOT NULL,
03 |     'title' VARCHAR2(255),
04 |     'feature' VARCHAR2(255),
05 |     'issue_id' INTEGER NOT NULL,
06 |     'script' VARCHAR2,
07 |     'pencils' VARCHAR2(255),

```



```

08 | 'links' VARCHAR2(255),
09 | 'colors' VARCHAR2(255),
10 | 'letters' VARCHAR2(255),
11 | 'editing' VARCHAR2(255),
12 | 'genre' VARCHAR2(255),
13 | 'characters' VARCHAR2,
14 | 'synopsis' VARCHAR2,
15 | 'reprint_notes' VARCHAR2(255),
16 | 'notes' VARCHAR2(255),
17 | 'type_id' INTEGER NOT NULL,
18 | PRIMARY KEY ('sid'),
19 | CONSTRAINT 'Issued_in'
20 |     FOREIGN KEY ('issue_id')
21 |     REFERENCES 'Issue' ('iid'),
22 | CONSTRAINT 'Story_of_type'
23 |     FOREIGN KEY ('type_id')
24 |     REFERENCES 'Story_Type' ('stid')
25 | );
26 |
27 | CREATE TABLE 'Issue' (
28 |     'iid' INTEGER NOT NULL,
29 |     'number' VARCHAR2(50),
30 |     'series_id' INTEGER NOT NULL,
31 |     'indicia_publisher_id' INTEGER,
32 |     'publication_dates' VARCHAR2(255),
33 |     'price' VARCHAR2(50),
34 |     'page_count' INTEGER,
35 |     'indicia_frequency' VARCHAR2(50),
36 |     'editing' VARCHAR2(255),
37 |     'notes' VARCHAR2(255),
38 |     'isbn' VARCHAR2(50),
39 |     'valid_isbn' VARCHAR2(50),
40 |     'barcode' VARCHAR2(50),
41 |     'title' VARCHAR2(255),
42 |     'on_sale_date' VARCHAR2(255),
43 |     'rating' VARCHAR2(50),
44 |     PRIMARY KEY ('iid'),
45 |     UNIQUE ('isbn', 'valid_isbn', 'barcode'),
46 |     CONSTRAINT 'Issue_of'
47 |         FOREIGN KEY ('series_id')
48 |         REFERENCES 'Series' ('seid'),
49 |     CONSTRAINT 'Published_by'
50 |         FOREIGN KEY ('indicia_publisher_id')
51 |         REFERENCES 'Indicia_Publisher' ('ipid')
52 |     ON DELETE SET NULL
53 | );
54 |
55 | CREATE TABLE 'Series' (
56 |     'seid' INTEGER NOT NULL,
57 |     'name' VARCHAR2(255) NOT NULL,
58 |     'format' VARCHAR2(255),
59 |     'year_began' INTEGER,

```

```

60 | 'year_ended' INTEGER,
61 | 'publication_dates' VARCHAR2(255),
62 | 'first_issue_id' INTEGER,
63 | 'last_issue_id' INTEGER,
64 | 'publisher_id' INTEGER NOT NULL,
65 | 'country_id' INTEGER NOT NULL,
66 | 'language_id' INTEGER NOT NULL,
67 | 'notes' VARCHAR2(255),
68 | 'color' VARCHAR2(255),
69 | 'dimensions' VARCHAR2(255),
70 | 'paper_stock' VARCHAR2(255),
71 | 'binding' VARCHAR2(255),
72 | 'publishing_format' VARCHAR2(255),
73 | 'publication_type_id' INTEGER,
74 | PRIMARY KEY ('seid'),
75 | CONSTRAINT 'First_issue_of'
76 |     FOREIGN KEY ('first_issue_id')
77 |     REFERENCES 'Issue' ('iid')
78 |     ON DELETE SET NULL,
79 | CONSTRAINT 'Last_issue_of'
80 |     FOREIGN KEY ('last_issue_id')
81 |     REFERENCES 'Issue' ('iid')
82 |     ON DELETE SET NULL,
83 | CONSTRAINT 'Produces'
84 |     FOREIGN KEY ('publisher_id')
85 |     REFERENCES 'Publisher' ('pid'),
86 | CONSTRAINT 'Series_from'
87 |     FOREIGN KEY ('country_id')
88 |     REFERENCES 'Country' ('cid'),
89 | CONSTRAINT 'Written_in'
90 |     FOREIGN KEY ('language_id')
91 |     REFERENCES 'Language' ('lid'),
92 | CONSTRAINT 'Series_of_type'
93 |     FOREIGN KEY ('publication_type_id')
94 |     REFERENCES 'Series_Publication_Type' ('sptid')
95 |     ON DELETE SET NULL
96 | );
97 |
98 | CREATE TABLE 'Indicia_Publisher' (
99 |     'ipid' INTEGER NOT NULL,
100 |     'name' VARCHAR2(255) NOT NULL,
101 |     'publisher_id' INTEGER NOT NULL,
102 |     'country_id' INTEGER NOT NULL,
103 |     'year_began' INTEGER,
104 |     'year_ended' INTEGER,
105 |     'is_surrogate' INTEGER,
106 |     'notes' VARCHAR2(255),
107 |     'url' VARCHAR2(255),
108 |     PRIMARY KEY (ipid),
109 |     UNIQUE ('name'),
110 |     CHECK ((is_surrogate = 0) OR (is_surrogate = 1) OR (is_surrogate IS
NULL)),

```

```

111 |         CONSTRAINT 'Owned_by'
112 |             FOREIGN KEY ('publisher_id')
113 |             REFERENCES 'Publisher' ('pid'),
114 |         CONSTRAINT 'Indicia_from'
115 |             FOREIGN KEY ('country_id')
116 |             REFERENCES 'Country' ('cid')
117 |     );
118 |
119 | CREATE TABLE 'Publisher' (
120 |     'pid' INTEGER NOT NULL,
121 |     'name' VARCHAR2(255) NOT NULL,
122 |     'country_id' INTEGER NOT NULL,
123 |     'year_began' INTEGER,
124 |     'year_ended' INTEGER,
125 |     'notes' VARCHAR2(255),
126 |     'url' VARCHAR2(255),
127 |     PRIMARY KEY ('pid'),
128 |     UNIQUE ('name'),
129 |     CONSTRAINT 'Publisher_from'
130 |         FOREIGN KEY ('country_id')
131 |         REFERENCES 'Country' ('cid')
132 | );
133 |
134 | CREATE TABLE 'Brand_Group' (
135 |     'bgid' INTEGER NOT NULL,
136 |     'name' VARCHAR2(255) NOT NULL,
137 |     'year_began' INTEGER,
138 |     'year_ended' INTEGER,
139 |     'notes' VARCHAR2(255),
140 |     'url' VARCHAR2(255),
141 |     'publisher_id' INTEGER NOT NULL,
142 |     PRIMARY KEY ('bgid'),
143 |     UNIQUE ('name'),
144 |     CONSTRAINT 'Held_by'
145 |         FOREIGN KEY ('publisher_id')
146 |         REFERENCES 'Publisher' ('pid')
147 | );
148 |
149 | CREATE TABLE 'Story_Type' (
150 |     'stid' INTEGER NOT NULL,
151 |     'name' VARCHAR2(50),
152 |     PRIMARY KEY ('sptid'),
153 |     UNIQUE ('name')
154 | );
155 |
156 | CREATE TABLE 'Series_Publication_Type' (
157 |     'sptid' INTEGER NOT NULL,
158 |     'name' VARCHAR2(50) NOT NULL,
159 |     PRIMARY KEY ('sptid'),
160 |     UNIQUE ('name')
161 | );
162 |

```

```

163 | CREATE TABLE 'Language' (
164 |     'lid' INTEGER NOT NULL,
165 |     'code' VARCHAR2(4) NOT NULL,
166 |     'name' VARCHAR2(50) NOT NULL,
167 |     PRIMARY KEY ('lid'),
168 |     UNIQUE ('code')
169 | );
170 |
171 | CREATE TABLE 'Country' (
172 |     'cid' INTEGER NOT NULL,
173 |     'code' VARCHAR2(4) NOT NULL,
174 |     'name' VARCHAR2(50) NOT NULL,
175 |     PRIMARY KEY ('cid'),
176 |     UNIQUE ('code')
177 | );
178 |
179 | CREATE TABLE 'Story_reprint' (
180 |     'srid' INTEGER NOT NULL,
181 |     'origin_story_id' INTEGER NOT NULL,
182 |     'target_story_id' INTEGER NOT NULL,
183 |     PRIMARY KEY ('origin_story_id', 'target_story_id'),
184 |     FOREIGN KEY 'origin_story_id' REFERENCES 'Story' ('sid'),
185 |     FOREIGN KEY 'target_story_id' REFERENCES 'Story' ('sid')
186 | );
187 |
188 | CREATE TABLE 'Issue_reprint' (
189 |     'irid' INTEGER NOT NULL,
190 |     'origin_issue_id' INTEGER NOT NULL,
191 |     'target_issue_id' INTEGER NOT NULL,
192 |     PRIMARY KEY ('origin_issue_id', 'target_issue_id'),
193 |     FOREIGN KEY 'origin_issue_id' REFERENCES 'Issue' ('iid'),
194 |     FOREIGN KEY 'target_issue_id' REFERENCES 'Issue' ('iid')
195 | );

```

1.3.1 Remarks

We thought about adding some constraints such that, for example, an indicia publisher or a brand group can not have the same url as their master publisher but did not find a way to do so.

1.4 Data Cleaning and Transformation Discussion

As we discussed in the first part, we found out that the csv file for Story was very dirty. We already suggested that every story should have an issue and a type, but still there are a lot of cleaning to do . For example, some rows have merged and as a consequence some titles have more than 1000 characters. For example, this is a title:

" Hi! Jack! Think fast! Catch!,Where Do We Stand?,237756,?,Lloyd Ostendorf (signed),Lloyd

Ostendorf (signed),?,?,drama; religious,,,,,19 1673616,Friendly Enemy...,237756,?,Charles Raab (signed),Charles Raab (signed),?,?,adventure,,,,,19 1673617,Crossword Puzzle,237756,?,Bill Berry ?,Bill Berry ?,?,,,,,,On inside front cover.,1 1673618,,,237756,,?,?,,,adventure,,,,,6 1673619,Announcing 3 Separate Editions of Our Little Messenger,,237755,?,?,?,typeset,,,,,On back cover.,16 1673620,Man wanted" "

It would be good to remove the lines that have merged and clean the data before putting it in the file again. We can replace these erroneous titles with a default title: "Story number " + id.

Moreover, we discussed the fact that some issues did not have an indicia publisher. We did not decide to declare that an issue must have an indicia publisher but it could actually be a good thing.

We can also assume that the first and last issue ids might not be accurate. To clean the first and last issue ids, we group the issues by series id in the series-issues relationship table, then we sort the issues by publication date and raise that the first issue id for each series should be equal to the series' first_issue_id. If there is more than one issue for the series, we raise that the last issue id should be equal to the last_issue_id. Then we can replace the erroneous ids with the correct ones.

1.5 General Comments

All group members have contributed equally to this first deliverable.

References

- [1] Ramakrishnan and Gehrke. *Database Management Systems, 3rd edition*. Mc Grawhill, 2003.