3. Exercise: Data Management Foundations

1. Data and Metadata

In the following excerpt of a STEP file from [1], which of the contained information refers to either data, metadata (schema) or meta-metadata (data model) from an engineering point of view:

```plaintext
ISO-10303-21;
HEADER;
/* Generated by software containing
 * JSDAI (TM) from LKSoft (www.lksoft.com, www.jsdai.net)
 * JSDAI Runtime Version 4.0.0 (Build 270, 2009-03-18T14:17:04)
 * JSDAI XIM Full Library Version 1.127.100 2009-03-05_21-45-33
 */
FILE_DESCRIPTION(
/* description */ (' Mentor Graphics BoardStation <=> AP210
Converter v3.2',' '),
/* implementation_level */ '2;1');
FILE_NAME(  
/* name */ 'd:\workspace\Flasher_thru_hole\flasher.stp',
/* time_stamp */ '2009-03-18T19:45:02',
/* author */ (' '),
/* organization */ (' '),
/* preprocessor_version */ ' Mentor Graphics BoardStation ',
/* originating_system */ 'Mentor Graphics BoardStation',
/* authorization */ 'LKSoftware GmbH');
FILE_SCHEMA(('AP210_ELECTRONIC ASSEMBLY_INTERCONNECT AND PACKAGING DESIGN_MIM { 1 0 10303 410 1 1 4}'));
ENDSEC;
DATA;
"#1=SPECIFICATION_DEFINITION('UM-PR-149-E-04','PCB Products Design Reference Manual',
 #4,#2);
 #2=PRODUCT_DEFINITION_CONTEXT('generic document definition',#3,'');
 #3=APPLICATION_CONTEXT('default application');
 #4=PRODUCT_DEFINITION_FORMATION('1',#,5);
 #5=PRODUCT('UM-PR-149-E-04','product',#(4290));
 #6=PRODUCTRELATED_PRODUCTCATEGORY( 'document',#,5,#12);
 #7=APPLIEDORGANIZATION_ASSIGNMENT(#9,#8,#1,#10);
 #8=ORGANIZATION_ROLE('document source');
 #9=ORGANIZATION('Mentor','Mentor Graphics Corporation',$);
 #10=SPECIFICATION_DEFINITION('8.7_1','AutoTherm User's Manual',#11,#2);
 #11=PRODUCT_DEFINITION_FORMATION('1',#,12);
 #12=PRODUCT('8.7_1','product',#,4290));
 #13=PRODUCT('board-PCB','pcb',#5111);
 #14=PRODUCT_DEFINITION_FORMATION('1',#,13);
...
ENDSEC;
END-ISO-10303-21;
```
2. **Aspects of Data Management**

Related to Engineering applications, explain the importance of the following data management aspects:

- Data Integration
- Data Security
- Data Quality

3. **Conceptual and Logical Schema Definitions**

Given the following schema definitions from [2] as a conceptual schema in EXPRESS-G and a logical schema using EXPRESS (both parts of the STEP standard), answer the following questions:

- What are the semantics of the two data models (i.e. what are the meanings of the syntactical constructs)?

- What are the semantics of the schema (i.e. what is the meaning of expressed application concepts)?

- How could the same schema be expressed using
  - a conceptual design model like ER or UML
  - a programming language like C, C++ or Java, or
  - a table schema in a relational database?

- How would the conceptual and logical schema have to be changed to also include
  - triangles?
  - arbitrary polygons?
SCHEMA simple_drawings;

ENTITY drawing;
  name : STRING;
  elements : SET [1:?] OF shape;
END_ENTITY;

ENTITY shape;
  label : STRING;
END_ENTITY;

ENTITY point SUBTYPE OF (shape);
  x : REAL;
  y : REAL;
END_ENTITY;

ENTITY line SUBTYPE OF (shape);
  end1 : point;
  end2 : point;
END_ENTITY;

END_SCHEMA;

[1]  www.wikistep.org
    AP 210 example: Flasher thru hole
    http://www.wikistep.org/index.php/Flasher_thru_hole