

ICM – Computer Science Major
M1 Cyber Physical and Social Systems
Course unit on Data Interoperability and Semantics

Tutorial 2

1) Delimiter-Separated Values

```
Time,Tel,Type,Message
1574431166,+33477421111,in,"Hey, let's get back to work on the project"
1574432836,+33477421111,out,"Let's meet this evening?
FYI John suggests Zoom at 8."
1574432945,+33477421111,in,"What is ""FYI"" ?"
1574433477,+33477421111,out,"That means For Your Interest"
1574433477,+33477421111,in,"ah
...
ok"
```

What is the data format of this document? What would be its mediatype?

What is the cell separator character? The field enclosing character?

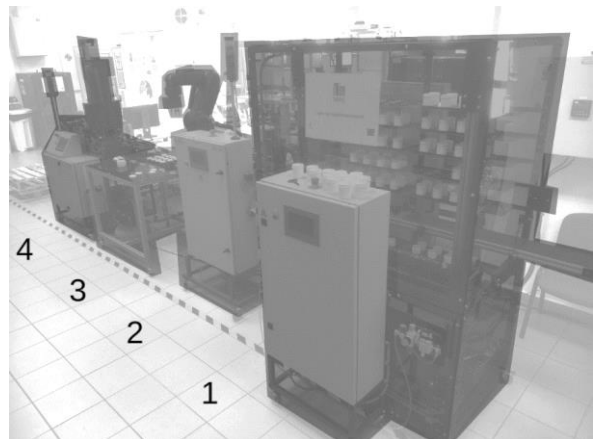
How many lines? How many columns? How many records?

What is the text content of message 1574432945 ?

2) JSON – IT'M Factory

The EMSE IT'M factory, inaugurated Sept. 24th 2018, simulates an industry 4.0 factory where containers (ex. pots of yoghurt) are filled with some product (ex. yoghurt), then packaged. As illustrated in the figure below, the production line is composed of a sequence of four workshops: 1) the “conveying workshop” (type VL10), 2) the “filling workshop” (type DX10), 3) the “potting workshop” (type APAS), 4) the packaging workshop (type XY10). Each workshop has an operating state (one of: running, paused, stopped, error)

Write a JSON document to describe this production line



3) YAML

Here is a simple YAML document

```
openapi: 3.0.0
info:
  title: Sample API
  description: |
    Simple example
    of an API
  version: 0.1.9
servers:
- url: http://api.example.com/v1
  description: main server
- url: http://staging-api.example.com
  description: staging
```

Write an equivalent JSON document

4) XML - Sitemap

A sitemap is a file where you provide information about the pages, videos, and other files on your site, and the relationships between them. Search engines like Google read this file to crawl your website more efficiently. A sitemap tells Google which pages and files you think are important in your website, and also provides valuable information about these files. For example, when the page was last updated and any alternate language versions of the page. (Source: Google)

Below is an example of a sitemap in XML format (Source: sitemaps.org) where I injected a few errors.

Circle the 4 syntax errors and the 2 other errors. Explain below how to correct them.

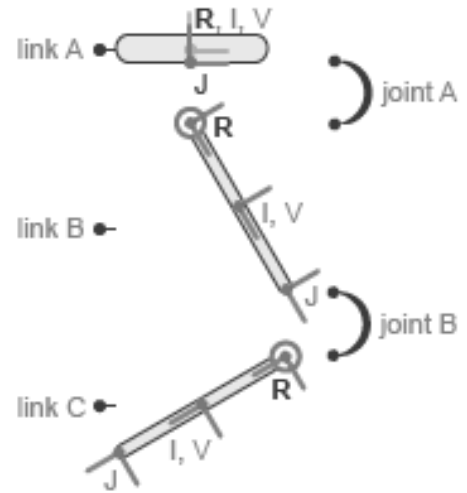
```
<?xml version=1.0 encoding="UTF-12"?>
<urlset xmlns="http://www.sitemaps.org/schemas/sitemap/0.9">
  <url>
    <loc>http://www.example.com/</loc>
    <lastmod>2005-01-01</lastmod>
    <changefreq>monthly</changefreq>
    <priority>0.8</priority>
  </url>
  <url>
    <loc>http://www.example.com/catalog?item=12&desc=vacation_hawaii</loc>
    <changefreq>weekly</changefreq>
  </url>
  <url>
    <loc>http://www.example.com/catalog?item=73&desc=vacation_new_zealand</loc>
    <lastmod>2004-12-23</modlast>
    <changefreq>weekly</changefreq>
  </url>
  <url>
    <loc>http://www.example.com/catalog?item=74&desc=vacation_newfoundland
    <lastmod>23-12-2004T18:00:15+00:00</loc></lastmod>
  </url>
  <url>
    <priority>0.3</priority>
    <url>
      <loc>http://www.example.com/catalog?item=83&desc=vacation_usa</loc>
      <lastmod>2004-11-23</lastmod>
    </url>
  </url>
```

5) XML - URDF

Unified Robotics Description Format, URDF, is an XML specification used in academia and industry to model multibody systems such as robotic manipulator arms for manufacturing assembly lines and animatronic robots for amusement parks. URDF is especially popular with users of Robotics Operating System, ROS. (Source: MathWorks)

Below is an example of a urdf description of a Double-Pendulum Model in XML format where I injected a few errors.

- Find the 5 syntax errors. Explain how to correct them.
- What color is link C ?



```
<?xml version="1.0" encoding="utf-8"?>
<link name="link A">
  <inertial>
    <origin xyz="0 0 0"/>
    <mass value="0.5"/>
    <inertia ixx="0.5" iyy="0.5" izz="0.5"
ixy="0" ixz="0" iyz="0"/>
  </inertial>
  <visual>
    <origin xyz="0 0 0"/>
    <geometry>
      <box size="0.5 0.5 0.1"/>
    </geometry>
    <material name="gray A">
      <color rgba="0.1 0.1 0.1 1"/>
    </material>
  </visual>
</link>
<link name="link B">
  <inertial>
    <origin xyz="0 0 -0.5"/>
    <mass value="0.5"/>
    <inertia ixx="0.5" iyy="0.5" izz="0.5"
ixy="0" ixz="0" iyz="0"/>
  </inertial>
  <visual>
    <origin xyz="0 0 -0.5"/>
    <geometry>
      <cylinder radius="0.05" length="1"/>
    </geometry>
    <material name="gray B">
      <color rgba="0.3 0.3 0.3 1"/>
    </material>
  </visual>
</link>
```

```
<link
name="link C">
  <inertial>
    <origin xyz="0 0 -0.5"/>
    <mass value="0.5"/>
    <inertia ixx="0.5" iyy="0.5" izz="0.5"
ixy="0" ixz="0" iyz="0"/>
  </inertial>
  <visual>
    <origin xyz="0 0 -0.5"/>
    <geometry>
      <cylinder radius="0.05" length="1"/>
    </geometry>
    <material name="xxx C">
      <color rgba="0.5 0.0 0.5 1"/>
    </material>
  </visual>
</link>
<joint name="joint A" type="continuous">
  <parent link="link A"/>
  <child link="link B"/>
  <origin xyz="0 0 -0.05"/>
  <axis xyz="0 1 0"/>
</joint>
<joint name="joint B" type="continuous">
  <parent link="link B"/>
  <child link= link C />
  <origin xyz="0 0 -1"/>
  <axis xyz="0 1 0"/>
  <dynamics damping = "0.002"/>
</joint>
```

6) FHIR

FHIR (Fast Healthcare Interoperability Resources) is designed to enable the exchange of healthcare-related information. This includes clinical data as well as healthcare-related administrative, public health and research data. It covers both human and veterinary medicine and is intended to be usable world-wide in a wide variety of contexts, including in-patient, ambulatory care, acute care, long-term care, community care, allied health, etc.

Many healthcare systems and technology vendors are already supporting the FHIR data standard, including the electronic medical record systems of the largest hospitals in the US, as well as major tech vendors such as Apple and Microsoft.

Below is a simple (modified) example of a document that describes a cholesterol diagnostic report.

```
{
  "resourceType": "Observation",
  "id": "cholesterol",
  "status": "final",
  "code": {
    "system": "http://loinc.org",
    "code": "35200-5",
    "display": "Cholesterol [Moles/volume] in Serum or Plasma"
  },
  "subject": {
    "names": {
      "official": {
        "use": "official",
        "family": "Chalmers",
        "given": [ "Peter", "James"]
      },
      "usual": {
        "given": "Jim"
      }
    },
    "birthDate": "1974-12-25"
  },
  "performer": [
    {
      "reference": "Organization/1832473e-2fe0-452d-abe9-3cdb9879522f",
      "display": "Acme Laboratory, Inc"
    }
  ],
  "valueQuantity": {
    "value": 6.3,
    "unit": "mmol/L",
    "system": "http://unitsofmeasure.org",
    "code": "mmol/L"
  },
  "referenceRange": [
    {
      "type": "high",
      "value": 4.5,
      "system": "http://unitsofmeasure.org",
      "code": "mmol/L"
    },
    { ... other objects with "type": "low" , "type": "reference", etc.}
  ]
}
```

- What would be the media type for this document when exchanged on the web?
- What is 1832473e-2fe0-452d-abe9-3cdb9879522f ?
- What interest is there in using codes from LOINC, SNOMED, or unitsofmeasure.org?
- What standard is the birth date expressed in?
- Write a JSONPath query to retrieve the usual given name of the patient
- Write a JSONPath query to retrieve the high reference value

Question 7: (12)

Here is a JSONSchema document

```
{
  "$id": "https://example.com/arrays.schema.json",
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "description": "A representation of a person, company, organization, or place",
  "type": "object",
  "properties": {
    "fruits": {
      "type": "array",
      "items": {
        "type": "string"
      }
    },
    "vegetables": {
      "type": "array",
      "items": { "$ref": "#/$defs/veggie" }
    }
  },
  "$defs": {
    "veggie": {
      "type": "object",
      "required": [ "veggieName", "veggieLike" ],
      "properties": {
        "veggieName": {
          "type": "string",
          "description": "The name of the vegetable."
        },
        "veggieLike": {
          "type": "boolean",
          "description": "Do I like this vegetable?"
        }
      }
    }
  }
}
```

Write a simple JSON document that validates against this schema with 2 fruits and 2 veggies.

Appendix A: JSONPath Cheat Sheet

Syntax

```
$.store.book[0].title  
$['store']['book'][0]['title']      # Alternative notation
```

Traversal

```
$.parentNode.childNode.field      # XPath: /parentNode/childNode/@field  
$..anyChildNode                    # XPath: //anyChildNode  
$.parentNode.*                     # XPath: /parentNode/*
```

Array Access

```
$.myList[0]                        # first element  
$.myList[-1]                       # last element  
$.myList[2:3]                      # range  
$.myList[0,4,5]                    # selection
```

Filtering

```
$.customer[?(@.car)]               # Only "customer"s that have attribute "car"  
$.customer[?(@.car == 'Ford Fiesta')] # Only "customer"s with "Ford Fiesta"s  
$.customer[?(@.age > 18)]           # Only adults
```

Complex Conditions

```
$.customer[?(@.age > 18 || @.car == 'Ford Fiesta')] # logical or  
$.customer[?(@.age < 18 && @.hobby == 'Biking' )]  # logical and
```