HL7 FHIR

HL7 International

FHIR Intermediate Course

MODULE 1

Assignments

Course Overview

Module I: Implementation Guides

Most Relevant FHIR Implementation Guides: Argonaut & IPS
Argonaut Development and Roadmap
Argonaut Data Query IG: Scope, Use Cases
Argonaut Provider Directory IG: Scope, Use Cases
IPS FHIR IG: Scope, Use Cases

Module II: FHIR Clients

General Guidelines for FHIR Clients
FHIR Clients in JavaScript / C#

Module III: FHIR Facades

Why Use FHIR Server Facade: Your System on FHIR
Specific FHIR Servers (FHIR Facade)
Facade Use Case / Scenarios
Facade Architecture / Patterns
Where to Put the FHIR Facade
System Integration / Integration Engine / Bus / Messaging
Facade in Java / Node.JS [1 - Elective]

Module IV: FHIR Applications

SMART on FHIR
CDS Hooks
Integration with SMART on FHIR/CDS Hooks [1 - Elective]

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Assignments for Unit 1 / Maximum Grade

Assignment	Total Points
Assignment U01-1: US CORE FHIR R4 MedicationRequest (JS)	15
Assignment U01-2: US CORE FHIR R4/IPS Medication (Mapping)	10
Assignment U01-3: US CORE FHIR R4 Vital Signs (Python)	10
Assignment U01-4: Screening Protocol Data (Terminology)	20
Assignment U01-5: FHIR Architectural Patterns (Architecture)	10
Assignment U01-6: US CORE Patient Goals Display (C#)	10
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Assignment U01-8: FHIR Architectural Patterns (Architecture)	15
	100

Minimum passing score for the unit is 35/100
You don´t need to solve all the assignments. You don´t need even to solve complete assignments. Just try all the assignments you can.

Assignment U01-1: US CORE FHIR R4 MedicationRequest (JS)

	**FHIR CODE REVIEWER**

The JavaScript code provided with this assignment should return a US CORE FHIR R4 Argonaut-conformant MedicationRequest resource for an athlete.
In case you do not remember where to find the specs, the spec for US CORE FHIR R4 is here: https://www.hl7.org/fhir/us/core/StructureDefinition-us-core-medicationrequest.html
Review the JavaScript code and answer:

a. Why doesn't this code return a valid Argonaut (US CORE R4) conformant MedicationRequest resource? State why the medication resource would be non-conformant. **[5 points]**
b. Submit the corrected code. **[10 points]**

You can test the JS code here: https://jsbin.com/tiqasuyeza/edit?html,js,console,output
You can also find the complete code here:
https://gist.github.com/diegokaminker/6dbd9a9325561cddd9a17c263177a631

Assignment U01-2: US CORE FHIR R4/IPS Medication (Mapping)

	**FHIR PROFILE GURU**

Our Sport application needs to show active medications for the patient. The following mapping is needed from our simple medication display model to the Argonaut MedicationRequest resource, to extract and **display only active medication for the patient.**
Now, we also want to process IPS resources and extract the same information, but we've noted that IPS uses MedicationStatement instead of MedicationRequest.
Your job is to write the FHIRPath expressions with the Argonaut US Core [5 points] and IPS mapping [5 points].

Additional Resources for this assignment:

The FHIRPath specification can be found here: http://hl7.org/fhirpath/
A FHIRPath tutorial (video) can be found here:
https://www.youtube.com/watch?v=m0nwSwUxg58

US Core MedicationRequest Profile: http://hl7.org/fhir/us/core/StructureDefinition-us-core-medicationrequest.html
US Core MedicationRequest example at the activity page

IMPORTANT : Test your FHIRPath before submit your activity at the course website using the FHIRPath sandbox and the examples.

Examples Resources at the material tools folder.
> medicationRequestUSCORE.json
> medicationStatementIPS.json

To retrieve the prescriber in both cases, as we just ask for the requester name, you can use the "display" element. You don't need to retrieve or resolve the referenced resource.

A FHIRPath sandbox to test your FHIRPath expressions can be found here:
http://niquola.github.io/fhirpath-demo/#/

Our Medication Display

column	description	datatype
MED_NAME	Prescribed Drug Name	string(128)
MED_CODE	Prescribed Drug Code	string(128)
MED_DATE	Date/Time of Prescription	date DD/MM/YYYY
MED_STATUS	Medication Status	string(50)
MED_PRESCRIBER	Full name of the prescriber	string(128)
MED_INSTRUCTION	Dosage instruction	string(max)

US CORE R4 Mapping
MedicationRequest

Display	US Core R4	Notes
MED_NAME		
MED_CODE		
MED_DATE		
MED_STATUS	MedicationRequest.status	
MED_PRESCRIBER		

IPS Mapping
MedicationStatement

Display	IPS FHIR	Notes
MED_NAME		
MED_CODE		
MED_DATE		
MED_STATUS		
MED_PRESCRIBER		

Assignment U01-3: US CORE FHIR R4 Vital Signs (Python)

BUILD YOUR OWN

The following Python* console program searches a Patient using given/family name, and after retrieving the patient's server-assigned id, retrieves all the Procedures and shows the date, status and description.

Your mission:

a) Change the program to enable Patient searching using at least 3 of the 5 mandatory search combinations in Argonaut R4 described here: https://www.hl7.org/fhir/us/core/StructureDefinition-us-core-patient.html#quick-start [5 points]

The user needs to select the search option and then enter the search parameters according to the selected options.

b) Change the program to retrieve and display the patient's vital signs (include all mandatory/must-support elements). The vital signs US Core profile is described here: https://www.hl7.org/fhir/us/core/vitals-search.html [5 points]

** We use standard Python 3 (no FHIR libraries required)*

You can run the provided program here:
https://repl.it/@fhirinterm/FHIRSearchPatientAndProcedures

Or download it from here:
https://gist.github.com/diegokaminker/35282deafa39da46eb51028b373d8d66

You can use your own Python installation or these free Python sandboxes:

- https://repl.it/repls
- https://trinket.io/features/python3
- https://www.onlinegdb.com/

Assignment U01-4: Screening Protocol Data (Terminology)

CLINICAL SENSE ON FHIR

Analyze the screening protocol for new athletes on pages 176-177 of the attached document **SportScreeningPaper.PDF**
For **labs, vitals and immunizations**, our application needs to provide all the items that can be downloaded automatically from an Argonaut or IPS server
Your job as the clinical interface consultant for the company is to resolve these issues.

1) **Section 0 – Profiles/Resources [3 points]**
Which Argonaut profiles will you use for each category (lab, vitals, immunization)?
2) **Section 1 - Immunization [6 points]**
Define **code/code system** for Immunization to download from the FHIR server for the vitals required by the paper. (Measles, mumps and rubella (combination vaccine), influenza, typhoid, Hepatitis A and B and yellow fever vaccine).
3) **Section 2 - Vitals [7 points]**
Define **code/code system** for Vital Signs to download from the FHIR server for the vitals required by the paper. (Blood pressure, heart rate, body height, body weight and the BMI)
4) **Section 3 - Labs [4 points]**
Define **code/code system** to download from the FHIR server for the clinical/microbiological results required by the paper.

Assignment U01-5: FHIR Architectural Patterns (Architecture)

YOU ARE THE ARCHITECT

Read the attached article in PDF format "FHIR Architectural Patterns – Helios Software."
The original article is here: https://blog.heliossoftware.com/fhir-architectural-patterns-ae828b13d40c

We will present 8 interoperability scenarios and you must assign the most appropriate pattern from the article to each scenario.
Options:
1 - Interoperability Interface
2 - FHIR Broker Adapter
3 - FHIR/Proprietary API Mixed Use
4 - FHIR Encapsulating a Vendor-Neutral Clinical Repository
5 - FHIR-Based Clinical Data Repository
6 - FHIR-Based Integration Hub
7 - FHIR-Based Analytical Solution
8 - Rapid FHIR-Based Endpoint

#	Scenario Description – or "this was what we heard at the meeting with their IT people"
01	"We don't have a FHIR/REST API server, but you can listen to our ongoing HL7 v2 pipeline and convert the messages to FHIR for your repository."
02	"We have our own read/write API – here are the 350 pages of the spec: www.bigehrvendor/proprietaryAPI/hugespecs. We can also provide you with an Argonaut FHIR read-only facade."
03	"You can use Argonaut bulk-data interface against our server for any dataset for your large dataset analysis. We support conditions, observations and patients out-of-the-box, but we can implement any specific request in two months" (this one was lying).
04	"We store all the information on a FHIR-based server. You can query our server using FHIR, but we also support HL7 V2.x, V3 and other formats."
05	"You can extract/update the information from our server for any purpose you want: EMR, labs, PACS and even research. We don't care which vendor provided the system, as long as they have a FHIR client."
06	Any Argonaut-compatible legacy EHR queried by a SMART on FHIR app.
07	Any Argonaut-compatible EHR with native FHIR-resources-based storage.
08	"No need to use HL7 V2 ORUs. We will post the lab report as a FHIR resource directly to your FHIR API endpoint."

Assignment U01-6: US CORE Patient Goals Display (C#)

BUILD YOUR OWN

The attached C# * WinForms program searches for a Patient using given/family name, and after retrieving the patient's server-assigned id, retrieves all the allergies and shows the display name, clinical status, and verification status.
Your mission:

1. Change the program to enable Patient searching using at least 3 of the 5 mandatory search combinations in Argonaut R4 described here: https://www.hl7.org/fhir/us/core/StructureDefinition-us-core-patient.html#quick-start [5 points]

The user needs to select the search option and then enter the search parameter(s) according to the selected option.

2. Change the program to retrieve and display only the patient's active clinical goals (include all mandatory/must-support elements). The Goals US Core profile is described here: http://hl7.org/fhir/us/core/StructureDefinition-us-core-goal.html [5 points]

* *We use the official support API for working with HL7 FHIR on the dotnet platform, available at: https://github.com/FirelyTeam/fhir-net-api*

The program is available in the compressed file **PatientAllergies.ZIP** at the material tools folder and requires Visual Studio 2017 or higher (.NET 4.6.1)

Assignment U01-7: US CORE FHIR R4 Implantable Device (C#)

FHIR CODE REVIEWER

Our company closed a deal with the site Cardiac Athletes and is providing support to recovering cardiac patients on running teams. So we have added support for Implantable Devices.
The C# code provided with this assignment should search for all the US CORE FHIR R4 Implantable Devices resources for an athlete on the Cardiac Athletes team and display all mandatory/must-support elements.
In case you do not remember where to find the specs, the spec for US CORE FHIR R4 is here: http://www.hl7.org/fhir/us/core/StructureDefinition-us-core-implantable-device.html

Review the C# code and answer:
a. Why does this code fail in searching the Implantable Devices for an athlete? [2 points]
b. Which mandatory/must-support elements is the program not showing? [3 points]
c. Submit the corrected code. [5 points]

** We use the official support API for working with HL7 FHIR on the dotnet platform, available at: https://github.com/FirelyTeam/fhir-net-api*

The program is available in the compressed file **ImplantableDevices.ZIP** at the Material Tools folder and requires Visual Studio 2017 or higher (.NET 4.6.1)

Assignment U01-8: FHIR Use Case Proposal (Architecture)

YOU ARE THE ARCHITECT

Read the article in PDF format “FHIR Use Case Proposal” by CareQuality at the Material tools folder.
Starting on page 10, there are descriptions of proposed scenarios called Vignettes 1, 2 and 3.
Which FHIR endpoints/resource types will be required to fulfill each scenario? [15 points]