Syllabus Content:

20.1 Programming paradigms

📚 Show understanding of programming paradigm

📚 Show understanding of the characteristics of a number of programming paradigms (low-level, imperative (procedural), object-oriented, declarative) –

📚 low-level programming

📚 **Declarative programming**

- o understanding of and ability to solve a problem by writing appropriate facts and rules based on supplied information
- o understanding of and ability to write code that can satisfy a goal using facts and rules

Programming paradigm:

A programming paradigm is a set of programming concepts and is a fundamental style of programming. Each paradigm will support a different way of thinking and problem solving. Paradigms are supported by programming language features. Some programming languages support more than one paradigm. There are many different paradigms, not all mutually exclusive. Here are just a few different paradigms.

Declarative programming: is a high-level programming concept, which is the opposite of imperative programming. It is typically found in databases

Prolog is a type of declarative programming language

Declarative Programming Basics:

A collection of clauses is called a **'knowledge base'**.

Writing a Prolog program means writing a knowledge base as a collection of clauses.

Facts:

A clause without a body is a fact, for example:

```
01    capitalCity(paris).
02    capitalCity(berlin).
03    capitalCity(cairo).
```

The meaning of clause

01 is: Paris is a capital city. **capitalCity(paris)** is a **compound term.**
Both **capitalCity** and **paris** are **atoms**.

capitalCity is called a **predicate** and **paris** is the **argument**.

Let's see some **past paper questions** to understand **Declarative Programming language syntax:**

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A declarative programming language is used to represent the knowledge base shown below:

```
01   capital_city(amman).
02   capital_city(beijing).
03   capital_city(brussels).
04   capital_city(cairo).
05   capital_city(london).
06   city_in_country(amman, jordan).
07   city_in_country(shanghai, china).
08   city_in_country(brussels, belgium).
09   city_in_country(london, uk).
10   city_in_country(manchester, uk).
11   country_in_continent(belgium, europe).
12   country_in_continent(china, asia).
13   country_in_continent(uk, europe).
14   city_visited(amman).
15   city_visited(beijing).
16   city_visited(cairo).
```

These clauses have following meaning:

Clause	Explanation
01	Amman is a capital city
06	Amman is a city in the country of Jordan
11	Belgium is a country in the continent of Europe
14	The travel writer visited Amman

If more facts are to be included

The travel writer **visited the city of Santiago** which is the **capital city of Chile**, in the **continent of South America**.

(a) Write additional clauses to record this

17 ....

....

18 ....

....

19 ....

....

20 ....

.... [4]

(a) Answer:

```
capital_city(santiago).
city_in_country(santiago, chile).
country_in_continent(chile, south_america).
city_visited(santiago).
```

accept in any order

Another task is to use the variable and get the answer from Declarative Programming Language: for example

(b)

Using the variable `ThisCountry`, the goal

```
country_in_continent(ThisCountry, europe)
```

returns

```
ThisCountry = belgium, uk
```

Write the result returned by the goal:

```
city_in_country(ThisCity, uk)
```

ThisCity = ...

....

(b) **Answer:**

```
(b)  ThisCity =
     manchester
     london
```

(c) Complete the rule below to list the countries the travel writer has visited.

countries_visited(ThisCountry)

IF

....

....

....

(c) **Answer:**

```
(c)  countries_visited(ThisCountry)
     IF
     city_visited(ThisCity)
     AND
     city_in_country(ThisCity, ThisCountry)
```

Another question of Declarative Programming

9608 MJ2015/43 Q-2: A declarative programming language is used to represent the knowledge base shown below:

```
01  dairy_product(cheese).
02  meat(beef).
03  meat(chicken).
04  meat(lamb).
05  made_with(burger, beef).
06  made_with(kofta, lamb).
07  made_with(quiche, cheese).
08  made_with(quiche, egg).
09  made_with(quiche, flour).
```

These clauses have the following meaning:

Clause	Explanation
01	Cheese is a dairy product
02	Beef is a meat
05	A burger is made with beef

(a) More facts are to be included. Laasi is made with the dairy products milk and yogurt. Write additional clauses to record this.

10...

11 ....

12 ....

13 ....

Answer:

2   (a)   `made_with(laasi, milk).`
           `made_with(laasi, yogurt).`
           `dairy_product(milk).`
           `dairy_product(yogurt).`

(b) Using the variable `TypeOfMeat`, the goal

     `meat(TypeOfMeat)`

returns

     `TypeOfMeat = beef, chicken, lamb`

Write the result returned by the goal:

     `made_with(quiche, Ingredient)`

     `Ingredient = ` ....

     ....

(c) Complete the rule to list the dishes made with meat.

```
contains_meat(Dish)

IF ............................................................................

............................................................................

............................................................................
```

Answer:

(b) `Ingredient =`
   cheese, egg, flour

(c) `contains_meat(Dish)`
   `IF`
   made_with(Dish, X)
   AND
   meat(X)

Refrecences:

- Cambridge AS & A level Coursebook
- Cambridge AS & A level Teacher's Resource
- AS & A level Computer Science by HODDER EDUCATION