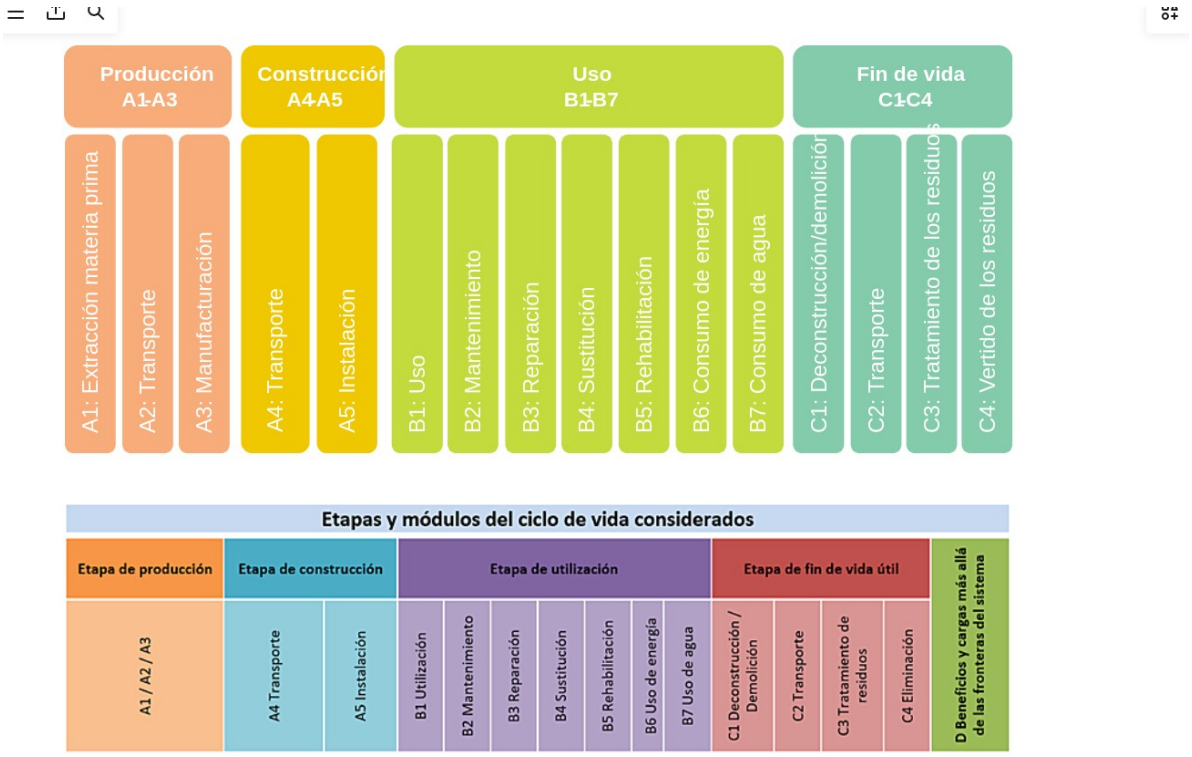
Exercise 1. Data Base Model

In a Company A, a new feature has been requested. The feature will work as a Life Cycle Assessment Calculator for measuring environment impacts of all the different processes and materials involved in the process of the creation of the product. Each LCA analysis is composed by different phases, described in the next image:



A LCA can be completely customized. That means that the LCA, depending on the context of the analysis, can include and exclude phases in order to calculate the impact in the environment. Example: when building the LCA of a phone, no water consumptions are involved in the process of fabrication for the phone, so B7 won't be present in the LCA.

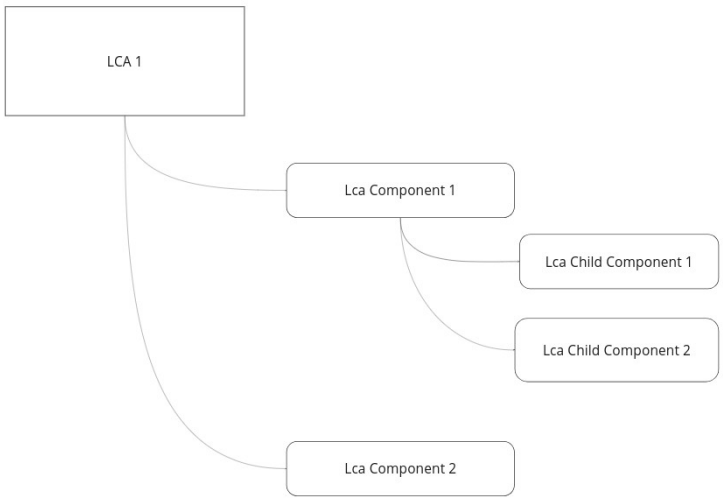
Each phase has a series of environment impacts linked to the LCA, described in the next picture:

Fases y materialidad	Quatity	Unit	Impacto (kg CO_2 eq)	Distribución del impacto
Producción	-	-	3.8	0.3%
Extracción de materia prima (A1)	0.02	kg	0.02	0.004%
Transporte (A2)	0.0035	ton km	0.0035	0.006%
Manufacturación (A3)	0.0066	kWh	0.0066	0.004%
Construcción	-	-	0.00356	0.434%
Transporte (A4)	400	ton km	0.00453	0.02%
Instalación (A5)	2800	kWh	0.434	0.434%
Uso	-	-	0.0002	0.434%
Uso (B1)	0.02	kWh	0.02	0.434%
Mantenimiento (B2)	0.02	kWh	0.02	0.434%
Reparación (B3)	-	-	0.02	0.434%
Sustitución (B4)	0.0035	kWh	0.0035	0.434%
Rehabilitación (B5)	-	-	0.0066	0.434%
Uso de energía (B6)	380	kWh	0.0066	0.434%
Fin de vida	-	-	0.00356	0.434%
Deconstrucción / Demolición (C1)	300	kJ	0.00453	0.434%
Transporte (C2)	200	ton km	0.434	0.434%
Tratamiento de residuos (C3)	-	-	0.02	0.434%
Vertido de residuos (C4)	-	-	0.02	0.434%

Any of the phases described above is conceptualized as an entity named LcaComponent. A LcaComponent contains information as:

- The acv which belongs to.
- The phase type
- quantity of the type
- unit of the type
- identificator of the source where it takes the impacts information

Take into account that a LcaComponent can be composed as a list of child LcaComponents, shown in the next diagram:



Finally, each LCA Component contains a list of impacts, which is grabbed from a source. In this processed, there are 2 entities identified:

- The source of the impacts. This can be:
  - An environment data base called EnvironmentDB
  - Another LCA analysis completed
- The entity Impact, which contains the value of an specific impact of an LCA Component for a impact type (it can be up to 50).

The information contained by each entity is:

- For the source:
  - identificator for the source
  - the name of the lcacomponent involved
  - the unit of the lca component (example: lca component material is measured in kg; lca component electricity is measure in kwh)
  - the version of the db
- For the Impact
  - id
  - value of the impact
  - the impact category applied

    - the source if, which can be an completed LCA or the EnvironmentDB

We allow the usage of a completed LCA as a source of impacts because it follows the same structure as the EnvironmentDB, and that completed LCA can be used to be a LCAcomponent for a new LCA_2.

The Task consists in:

Build a solution, coded in Python, which meets the next requirements:

- **The solution contains a DB (ex: Sql Lite), saving all the entities/models created (3/10 points)**
- **The solution allows to create a LCA Component (2/10 points)**
- **Allows to create child LCA Components with more than one level of LCA child components (n levels of child relations) (3/10 points)**
- **Takes into account that the LCA Impacts of a Parent LCA Component depends on the Child LCA Component (2/10 points).**

Notes:

Be as concise as possible to ensure clarity and readability.
It will help to understand the code if you add a list of requirements and instructions to run the code. It is mandatory to provide a solution which works.

Exercise 2. System Design

In a Company A, There is an environmental software which works with asynchronous calculations to provide carbon emissions which are based on the input provided by the client, via manual uploads of documents. The entire software is located in Amazon Web Services.

It has been requested by a client an integration of the software with the client's infrastructure, completely skipping the manual uploads and the retrieval of information from the platform itself.

The way the software works is by receiving documents such as Excel's or Csv's, containing rows of input to be processed, and for each of those rows it will calculate an linked carbon emission. The calculation of a row's carbon emission involves a chain of calculations which can take some time (let's assume 1 minute per row for this excersise). The total time needed for the processing of a document will depend on the amount of rows to be processed.

The client at any time can access the platform , where it will see how the document updates the processed content frequently, so the client won't need to wait until the entire document is processed in order to start seeing results.

The Task consists in:

Design an architecture of an idealistic solution which can solve the needs of the client. Provide architecture designs, documentation, and whatever you think it can be useful in order to explain the answer provided as complete as possible.

Notes:

- **Take into account that the retrieval of processed information needs to be limited in order to avoid high costs on executions of AWS resources.**
- **Take into account that the processing of a document can take several time, but the client only wants to retrieve the info once the document has been completely processed. You can use this info to limit the amount of queries done by the client.**

The solution submitted must meet the next criteria:

- **Clear Diagrams using AWS resources (3/10 points)**
- **Clear Documentation and explanations of the code flow designed (4/10 points)**
- **The solution takes into account changes in time processing (2/10 points)**
- **The solution is following the Best Architecture Design principles (1/10 points)**

Exercise 3. System Design

In a Company A, which makes a software of environmental applications, it works with a relational database based in the usage of PostgresSql. The way it interacts with the DB is via Python making queries to the DB with the ORM framework SqlAlchemy.

The Task consists in:

Based in the answer provided in Exercise 1, provide the pseudo code, coded in Python, of the next functions:

- **A function to retrieve the last LcaComponents of a chain of LcaComponents for a particular phase (example, a1).**
- **A function to update the impacts of a particular LcaComponent with a fixed value**

Extra (Optional) ----

- **A function to calculate the impact of a particular parent LcaComponent, based on the update of an impact for a child LcaComponent. The relation is described as:**
  - **The parent LcaComponent is composed by 2 child LcaComponents**
  - **child LcaComponent 1 is causing 80% of the impacts of parent LcaComponent**