

Database Design and Implementation

MONASH-BINS-ARE-US (MBAU)

Municipal councils in Melbourne have been looking for a way to encourage residents to create sustainable households. One area that is being look at is reducing the amount of rubbish that is not recycled. Together with the Monash Smart Bins company, the councils intend to introduce the concept of a Pay-As-You-Throw (PAYT) program. Unlike the current rubbish collection program that requires residents to pay a flat rate as part of their council rate payment for rubbish collection, the PAYT program will charge the residents based on the volume of rubbish which is collected. To enable this program, the councils have hired the Monash Smart Bins company to introduce sensors-based rubbish bins to be used by the residents. These smart bins will be equipped with the sensors that are able to detect the content's volume within the bin. The data from these sensors will be collected to determine the charges to be invoiced by the councils to the residents.

There are three key players in this program, the council, the bins company and the residents. The responsibilities and activities of each player are described below.

Council

- Negotiates and signs a contract with the bins company. In the contract, the types of bin supported, the cost of providing each type of bins and the cost to collect the bins as needed are agreed upon. The contract is agreed for a certain duration. Near the end of the contract date, a new contract will be negotiated between the councils and the bins company.
- Provides the list of addresses of the residents in their municipality boundary. *The councils will not provide the house owner details to the bins company as the invoice to the resident will come from the councils instead of the bins company.* The bins company will invoice the council quarterly for all the amounts incurred for that period based on the rate agreed in the contract. A report produced by the bins company will show the collection details for the quarter. The details include the types of collection (green, recycle or general waste) and the volume collected for each residential property.

Resident

- Informs the council of taking residency in the council managed area and registers online for the bins program.
- Downloads the smart bin application to manage the rubbish collection. Ensures that the bins' id is entered correctly in the app for accurate invoicing.
- Submits a rubbish collection request using the application when:
 - The bins sensors sends a "FULL" signal to the application.
 - The resident wants the bins to be emptied even though the bins are not full.
 Since a house may have three types of bin, the request for a collection must be made for each type of bin so the company can send the appropriate type of truck to collect the bin.
- Puts a bin replacement request into the application when a damaged bin is detected.
- Makes sure that the bin is placed on the roadside on the day collection is requested.

Bins Company (Monash Bins Are Us)

- Manages the details of the signed contract to allow proper invoicing to be delivered to the councils. The company provides a set of standard types of bin, such as green, recycle and general waste bins. For each bin type, the company also provide standard set of sizes, such as 40 litre, 80 litre etc. The costs of the bins and their collection are negotiated between the company and the individual council. The costs may differ across contracts and municipalities.
- Manages the trucks and drivers scheduling to allow:
 - Delivery of new bins to residents.
 - Replacement of faulty bins.
 - Collection of bin contents
- Generates a quarterly detailed invoice to the councils.
- Generates the quarterly report detailing the collections for each property.
- Collects bins according to the collection requests posted by the residents on their PAYT application.
- Delivers new bins to a new building.
- Replaces broken bins.

Business processes and their associated business rules.

Bin Management

The bins company provides different types and volumes of bins. Some of the types are general waste, green waste and recycle waste. The available volumes are 40 litre, 80 litre and 100 litre. Each of the bin is equipped with a multi-functions sensor board. A unique id is attached to each sensor attached to the bin as an identifier. A new bin is delivered to a property for one of these reasons:

- when it is requested by the council.
- when a bin is reported to be faulty by resident and a replacement is needed.
- when the sensor sends a faulty signal to the company and needs to be replaced.

Collection Management

The bins company employs a group of drivers to operate the collection trucks. Everyday, a schedule for collections is prepared. The schedule lists all the collection addresses, the truck registration number plate and two driver ids. For each collection, two drivers are assigned to a truck. The company records driver details such as the driver license number, driver name, date of birth, tax file number and home address.

The company operates a fleet of trucks. The truck details include truck vehicle identification number, registration number plate, make, model, year, current availability (Y/N). The availability is set to N when the truck is out for maintenance.

Contract, Invoice and Report Management

Example of costing included in the contract.

Municipality Name: City of Glen Eira Contract No: 345 Period of Contract: 1-Jan-2016 to 31-Dec-2018		
Bin Cost		
Bin Type	Size (Litre)	Cost (\$AUD)
Green	40	100
Green	80	150
Green	100	200
Recycle	40	120
Recycle	80	160
Recycle	100	220
General Waste	40	100
General Waste	80	150
Collections Cost		
Green	\$1/kg	
Recycle	\$1.20/kg	
General waste	\$2/kg	

Example of an INVOICE.

Invoice No: 24567 Municipality Name: City of Glen Eira Contract No: 345 Quarter: 1-Jan-2016 to 31-Mar-2016 Year: 2016 Paid by: 30-April-2016				
Bin Cost				
Bin Type	Size (Litre)	Unit Cost (\$AUD)	Units	Total
Green	80	150	500	75,000
Green	100	200	1000	200,000
Recycle	80	160	500	80,000
Recycle	100	220	1000	220,000
General Waste	40	100	800	80,000
General Waste	80	150	700	105,000
			Subtotal	760,000
Collection Cost				
Collection Type		Unit Cost (\$AUD)	Units (kg)	
Green		1	100,000	100,000
Recycle		1.2	129,000	154,800
General Waste		2	89,100	178,200
			Subtotal	433,000
			Grand Total	1,193,000

The "Units" and "Total" in this invoice is calculated when the invoice is produced based on the specified period of the invoice, eg quarter 1.

Example of a quarterly collection report.

Municipality Name: City of Glen Eira Contract No: 345 Quarter: 1-Jan-2016 to 31-Mar-2016 Year: 2016		
Property	Collection Type	Total collected (kg)
900 Dandenong rd	Green	56
	Recycle	70
	General	45
1/901 Dandenong rd	Green	45
	Recycle	70
	General	60
etc		

The "Total collected" in this report is calculated when the report is produced based on the specified period of the report, eg quarter 1. It is the sum of all collections made on the property for that particular quarter.

Your task is to design and build a database for the *bins company* to allow them to manage the contract, quarterly invoices and the scheduling of trucks and drivers to perform the required bins activities (delivery, replacement, rubbish-collection).

TASKS

1. Prepare an initial conceptual model (Entity Relationship Diagram) for Monash Bins Are Us (MBAU). For this initial conceptual model, *only include what you see as identifiers for each entity*, do not include other attributes at this stage. *Participation and connectivity for relationships must be shown on the diagram.* **(10 marks)**
2. Prepare a logical level design for the MBAU database. The logical model must be drawn using the Oracle Data Modeler. The information engineering or Crow's foot notation must be used in drawing the model. All attributes must be commented in the database. Sequences must be used to generate primary key and check clauses must be applied to attributes where appropriate. Be sure to include the legend as part of your model. **(40 marks)**
3. Generate the schema for the database in Oracle Data Modeler and use the schema to create the database in your Oracle account. The **only** edit you are permitted to carry out to the generated schema file is to add a header comment/s containing your details (student names of those in your group) and drop sequence commands. Capture the output of the schema statements using the spool command. Name the schema file as **mbau_schema.sql**. Include a script containing the drop table statements for your database. Name the script **mbau_drop_table.sql**. **(10 marks)**
4. Code an Oracle insert script (**mbau_insert.sql**) which will insert suitable sample data into your model. Your script must insert a *minimum* of four rows into each table. The data about the properties should include a combination of an address with a single property and an address with multiple properties (eg units or apartments). You need to make sure the sample data can show how the data are modified in question 5 and 6. **(15 marks)**
5. The data in the MBAU database may change overtime to support the business process. Write an Oracle script (**mbau_q5.sql**) to modify the content of MBAU database to reflect a situation whereby the municipal boundary has changed and a street with multiple properties has changed municipality from one to another one. Both municipalities exist in the database. **(10 marks)**
6. MBAU needs to deal with bins that are associated with a demolished building where multiple properties are present. The database needs to be changed to reflect the situation. Write the steps that your team will take to ensure this situation is reflected as changes to the structure and/or content of the database. Write Oracle script(s) to modify the MBAU database to reflect a situation. When providing the solution, you need to ensure that all collection records of those bins that have not been included in the invoice to date will not be lost. Name the file **mbau_q6.sql**. If you have multiple scripts, name the file **mbau_q6a.sql**, **mbau_q6b.sql**, etc **(15 marks)**

Your team will need to work on and share a single set of tables - to do this one member of the team should create the tables and then use the [SQL DCL command GRANT](#) to allow access to the other member of the team.

Submission Requirements

Due: Friday 12-MAY-2017 11 PM (week 10)

This assignment should be completed in a group of two. The final mark of team members may differ depending on the level of contribution to the submission. Students will be asked to complete peer assessment after their submission.

The following files are to be submitted:

- A pdf file containing the conceptual model. Name the file **mbau_conceptual.pdf**
- A pdf file containing the final logical Model you created in Oracle Data Modeller. Name the file **mbau_logical.pdf**
- A zip file containing your Oracle data modeler project (in zipping these files be sure you include the .dmd file and the folder of the same name). Name the file **mbau_OracleModel.zip**. This model must be able to be opened by your marker and contain your full model *otherwise your part B will not be marked*. For this reason, you should carefully check that your model is complete - as a suggestion you should take your submission archive, copy it to a new temporary folder, extract your submission parts, extract your model and ensure it opens correctly *before* submission.
- A schema file (CREATE TABLE statements) generated by Oracle Data Modeller. Name the file **mbau_schema.sql**
- The output from SQL Developer showing the tables have been created. Name the file **mbau_schema_output.txt**
- A copy of your insert file (**mbau_insert.sql**) and the output showing successful insert of your test data (**mbau_insert_output.txt**)
- A copy of your script for task 5 (**mbau_q5.sql**) and the output showing the task has been completed. (**mbau_q5_output.txt**)
- For task 6:
 - a pdf file listing the steps taken to deal with the scenario. Name the file **mbau_q6_steps.pdf**
 - a copy of the script(s) (**mbau_q6.sql**) to implement the steps specified in the pdf file and the output **mbau_q6_output.txt**.
- A pdf document containing any assumptions you have made in developing the model or comments your marker should be aware of. Name the file **mbau_assumptions.pdf**

Note that there are at least **thirteen required files**. These files must be zipped into a single zip file in Moodle named a2-<yourauthcateid1>-<yourauthcateid2>.zip e.g., a2-xyz123-abc567.zip before the assignment due date/time. Submit the a2-<yourauthcateid1>-<yourauthcateid2>.zip to Moodle before the due date. One submission per-group but **each member has to press SUBMIT to complete the submission**.