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Data Types:

Household

Attribute	Data Type	Nullable
Email	String	Not Null
Square Footage	int	Not Null
Number of Occupants	int	Not Null
Number of Bedrooms	int	Not Null
Household Type	String	Not Null

Phone

Attribute	Data Type	Nullable
Phone Type	String	Not Null
Area Code	String	Not Null
7 Digits	String	Not Null

Has

Attribute	Data Type	Nullable
Bathroom #	int	Not Null

Bathroom

Attribute	Data Type	Nullable
Number of Sinks	int	Not Null
Number of Bidets	int	Not Null
Number of Commodes	int	Not Null
Is Primary Bathroom	Boolean	Not Null

Half Bathroom

Attribute	**Data Type**	**Nullable**
Half Bath Name	String	Null

Full Bathroom

Attribute	**Data Type**	**Nullable**
Tub/Shower Count	int	Not Null
Bathtub Count	int	Not Null
Shower Count	int	Not Null

City Info (Postal Code)

Attribute	**Data Type**	**Nullable**
Postal Code	String	Not Null
City	String	Not Null
Longitude	String	Not Null
Latitude	String	Not Null
State	String	Not Null

Contains

Attribute	**Data Type**	**Nullable**
Appliance #	int	Not Null

Appliances

Attribute	**Data Type**	**Nullable**
Model	String	Null

Manufacturer

Attribute	**Data Type**	**Nullable**
Manufacturer	String	Not Null

Dryer

Attribute	Data Type	Nullable
Heat Source	String	Not Null

Fridge

Attribute	Data Type	Nullable
Fridge Type	String	Not Null

TV

Attribute	Data Type	Nullable
Max Resolution	String	Not Null
Display Size	String	Not Null
Display Type	String	Not Null

Washer

Attribute	Data Type	Nullable
Loading Type	String	Not Null

Cooker - Oven

Attribute	Data Type	Nullable
Oven Type	String	Not Null
Heat Source	List<String>	Not Null

Cooker - Cooktop

Attribute	Data Type	Nullable
Heat Source	String	Not Null

Business Logic Constraints

User

- If email is already in database, an error message should be displayed
- Email must be populated

Postal Code

- Postal code must be found on the city vs. postal code relation

Phone

- One per household
- If phone number is already in database, an error message should be displayed

Bathroom

Half Bathroom

- Must have at least one sink, commode, and/or bidet
- May have optional name

Full Bathroom

- Must have at least one sink, commode, and/or bidet
- Must have at least one bathtub, shower, or tub/shower
- May have no more than 1 primary bathroom

Appliances

- May have optional model name

Email Form

Task Decomp

Lock Types: Lookup for email in Household.
Number of Locks: Single
Enabling Conditions: Choosing to enter household info from the start screen.
Frequency:
Consistency (ACID): Consistency is critical to make sure there are no duplicate emails.
Subtasks: Mother task and task decomposition not needed.

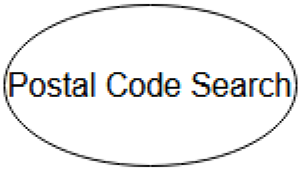
Abstract Code

- User enters email ('$Email') in input field
- When **Submit** button is pressed:
    - If Email is already in database:
        - Go back to Email Form with error message
    - Else:
        - Proceed to **Postal Code Search**

Postal Code Search

Task Decomp

Lock Types: Read-only lookup of Postal Code.
Number of Locks: Single
Enabling Conditions: Submitting a valid email.
Frequency:
Consistency (ACID): Not critical, order is not critical.
Subtasks: Mother task and task decomposition not needed.



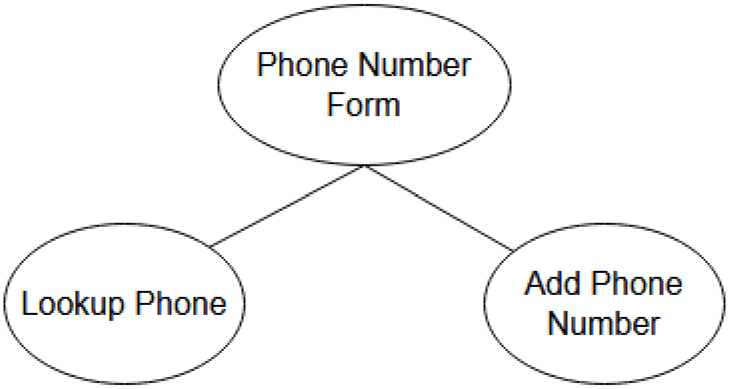
Abstract Code

- User enters *postal code* ('$Postal_Code') in input field
- When ***Submit*** button is pressed:
    - Find current postal code in City Info
    - If postal code is in database of postal codes:
        - Display postal code and corresponding city and state
        - Ask User if the information is correct
    - Else : return **Postal Code Form** with error message
- Display the city information corresponding to the postal code entered.
- When ***Yes*** button is selected:
    - Proceed to **Phone Number Form**
- When ***No*** button is selected:
    - Return to beginning of **Postal Code Form**

Phone Number Form

Task Decomp

Lock Types: Lookup and write-lock for Phone.
Number of Locks: Single
Enabling Conditions: Confirming postal code.
Frequency: Same as Postal Code Search.
Consistency (ACID): Consistency is critical to make sure there are no duplicate phone numbers, and must be done in order.
Subtasks: Mother task is needed. Must first check for duplicate phone numbers before writing a new one.



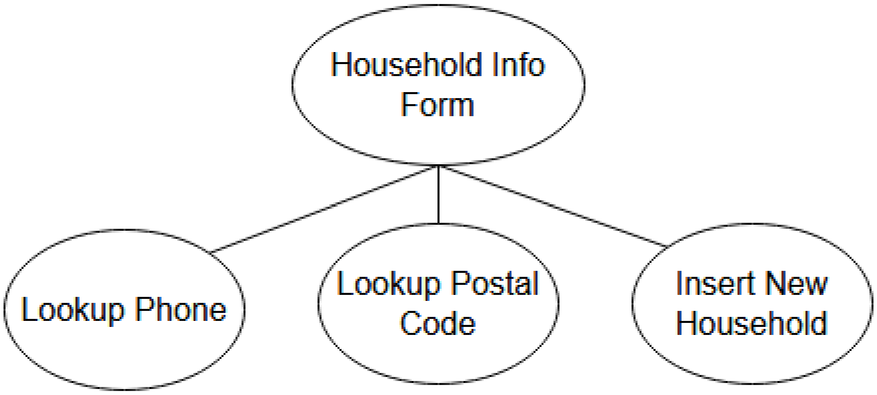
Abstract Code

- Ask user if they would like to enter a phone number
- If **Yes** button is selected:
  - Display Area Code, Number, and Phone type text entries fields
  - User enters *area code* ('$Area_Code') in input field
  - User enters remaining *7 digits* ('$7_Digits') in input field
  - User Selects *phone type* ('$Phone_Type') from drop down list of: home, mobile, work or other
  - The entered phone number, combination of (('$Area_Code') and ('$7_Digits')) must not be previously recorded. If so, return to **Phone Number Form** and show error message
- If ***No*** button is selected:
  - Proceed to **Household Info Form**
- When ***Next*** button is selected:
  - Proceed to **Household Info Form**

Household Info Form

Task Decomp

Lock Types: Write-lock on Household, and 2 identifier lookups for Postal Code and Phone.
Number of Locks: Three schema constructs
Enabling Conditions: Confirming phone number.
Frequency:
Consistency (ACID): Not critical even if Email/Postal Code/Phone are being altered.
Subtasks: Mother task is needed; all tasks must be done, but not necessarily in order.



Abstract Code

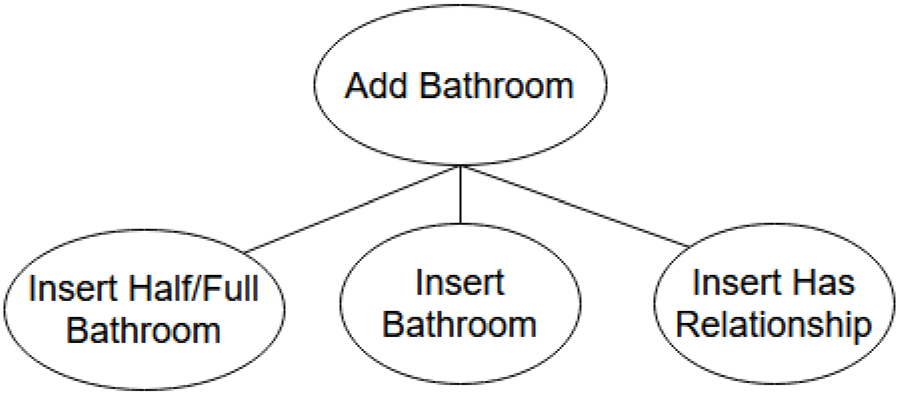
- User selects *home type* ('$Home_Type') from a drop down list of: house, apartment, townhome, condominium, or mobile home
- User enters *square footage* ('$Square_Footage') in input field
- User enters *number of occupants* ('$Number_Of_Occupants') in input field
- User enters *number of bedrooms* ('$Number_Of_Bedrooms') in input field
- When ***Next*** button is selected:
    - Insert the user entered info (household info from **Household Info form**, previously entered **Postal Code Form**, and **Phone Number Form.**) into the DB.
    - Proceed to **Bathroom Info Form**

Bathroom Form

Task Decomp

Add Bathroom

Lock Types: Write-lock for Bathroom and either of Half/Full Bathroom.
Number of Locks: Three schema construct
Enabling Conditions: Confirming household info.
Frequency:
Consistency (ACID): Consistency is needed because any added Bathroom needs to be relisted.
Subtasks: Mother task is needed, and tasks must be done in order; information regarding a Half/Full Bathroom will be added, then the rest of a Bathroom, and lastly the Has relationship.



Abstract Code

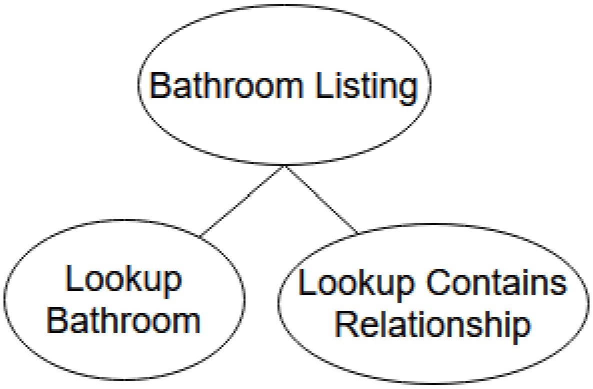
- Ask user if they have a half bathroom
    - If ***Yes*** is selected (tab selecting "half"):
        - User enters *sinks* ('$Number_of_Sinks') in input field
        - User enters *commodes* ('$Number_of_Commodes') in input field
        - User enters *bidets* ('$Number_of_Bidets') in input field
        - User enters *half bath name* ('$Half_Bath_Name') in input field
            - This field is optional
        - When ***Add*** is selected:
            - Increment *bathroom #* ('$Bathroom_#') by 1
            - Insert user input into the DB.
            - Jump to task Bathroom Listing
    - If ***No*** is selected (tab selecting "full"):
        - Ask the user if they have a full bathroom
            - If Yes is selected (Always true as long as the user interacts with the interface correctly):

    - User enters *sinks* (‘$Number_of_Sinks’) in input field
    - User enters *commodes* (‘$Number_of_Commodes’) in input field
    - User enters *bidets* (‘$Number_of_Bidets’) in input field
    - User enters *bathtubs* (‘$Number_of_Bathtubs’) in input field
    - User enters *showers* (‘$Number_of_Showers’) in input field
    - User enters *tub/shower* (‘$Number_of_TubShowers’) in input field
    - If primary bathroom is set to false:
        - User may select the *is primary bathroom* (‘$Is_Primary_Bathroom’) check box
    - Else:
        - User can not select check box
    - When ***Add*** is selected:
        - Increment *bathroom #* (‘$Bathroom_#’) by 1
        - Insert user input to the DB.
        - Jump to task **Bathroom Listing**

- If No is selected (Cannot happen if user interface is used correctly):
    - Display an error message indicating that the user must have one bathroom
    - Return to **Bathroom Info Form**

Bathroom Listing

Lock Types: Read-lock for Bathroom and Household
Number of Locks: Three schema construct
Enabling Conditions: After adding a Bathroom.
Frequency:
Consistency (ACID): Consistency is needed to ensure any previously added Bathrooms show up in the list.
Subtasks: Mother tasks are needed; all tasks must be done, but not necessarily in order.



Abstract Code

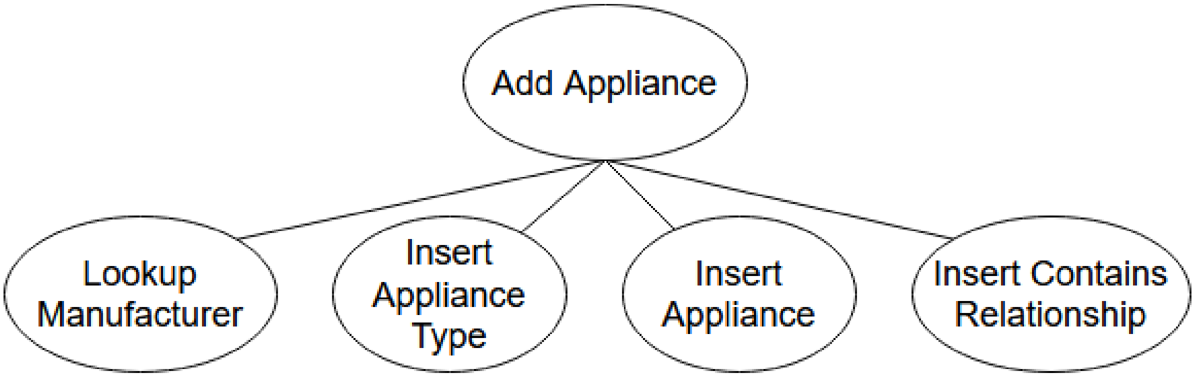
- Display a table of all bathrooms added in the order in which they were added (Bathroom ID) as well if they were half/full and if they were marked as primary
    - Since this will be shown after each entry of households, there must exist at least one data to display.
- User responds if they want to ***Add another bathroom***
    - When ***Add Another Bathroom*** is selected:
        - Return to the beginning of **Bathroom Form**
    - When ***Next*** is selected:
        - Continue to **Appliance Form**

Appliance Form

Task Decomp

Add Appliance

Lock Types: Lookup for Manufacturer and write-lock for Household, Appliance and the type of Appliance.
Number of Locks: Minimum four schema constructs, up to five if the appliance is a cooker.
Enabling Conditions: After finishing, add all bathrooms.
Frequency:
Consistency (ACID): Order is critical due to Appliance's dependency on Manufacturer and Appliance type.
Subtasks: Mother tasks are needed, and tasks must be done in order.



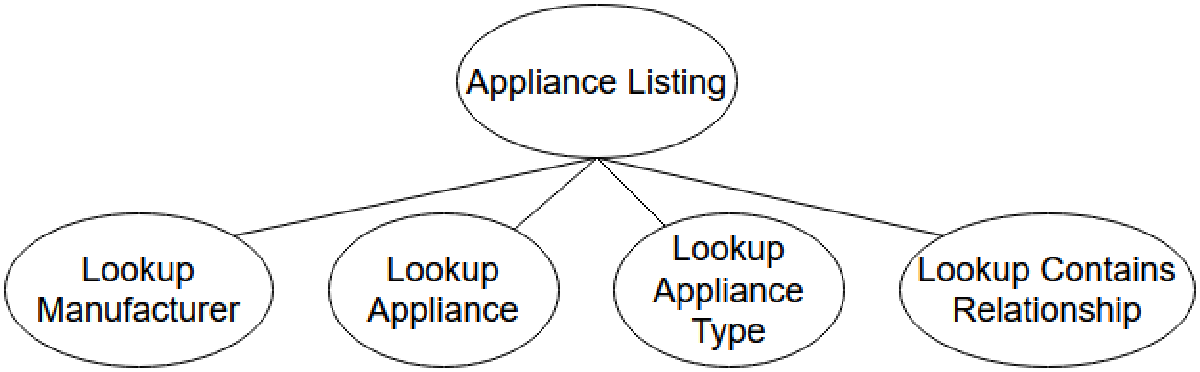
Abstract Code

- User selects *appliance type* (‘$Appliance_Type) from a drop down list of: dryer, fridge, TV, washer, and cooker.
- User enters *manufacturer* (‘$Manufacturer’) in input field
- User enters *model* (‘$Model) in input field
    - This field is optional
- If *appliance type* Dryer is selected:
    - User selects *heat source* (‘$Heat_Source) from a drop down list of: gas, electric, or none
- If *appliance type* Fridge is selected:
    - User selects *fridge type* (‘$Fridge_Type) from a drop down list of: bottom freezer refrigerator, French door refrigerator, side-by-side refrigerator, top freezer refrigerator, chest freezer, or upright freezer.
- If *appliance type* Washer is selected:
    - User selects *loading type* (‘$Loading_Type) from a drop down list of: top or front
- If *appliance type* TVis selected:

    - User selects *display type* (‘$Display_Type) from a drop down list of: tube, DLP, plasma, LCD, or LED
    - User selects *max resolution* (‘$Max_Resolution) from a drop down list of: 480i, 576i, 720p, 1080i, 1080p, 1440p, 2160p (4K), or 4320p (8K)
    - User enters *display size*(‘$Display_Size) in input field
- If *appliance type* Cooker is selected:
    - User selects Oven or Cooktop checkbox
        - If Cooktop is checked:
            - User selects *cook heat source* (‘$Cook_Heat_Source’) from a drop down list of: gas, electric, radiant electric, or induction
        - If Oven is checked:
            - User selects *oven heat source* (‘$Oven_Heat_Source’) from a checkbox list of: gas, electric, and or microwave
            - User selects *oven type* (‘$Oven_Type’) from a drop down list of: gas, electric, radiant electric, or induction
- When ***Add*** button is selected:
    - Increment *appliance #* (‘$Appliance_#’) by 1
    - Insert user input into DB.
    - Jump to task **Appliance Listing**

Appliance Listing

Lock Types: Read-lock for Household, Manufacturer, Appliance and Appliance Types.
Number of Locks: Minimum six locks, up to twelve locks if the Household has every type of Appliance.
Enabling Conditions: Proceeded from adding appliances.
Frequency:
Consistency (ACID): Consistency is needed to ensure any previously added Appliances show up in the list.
Subtasks: Mother tasks are needed, and tasks must be done in order.



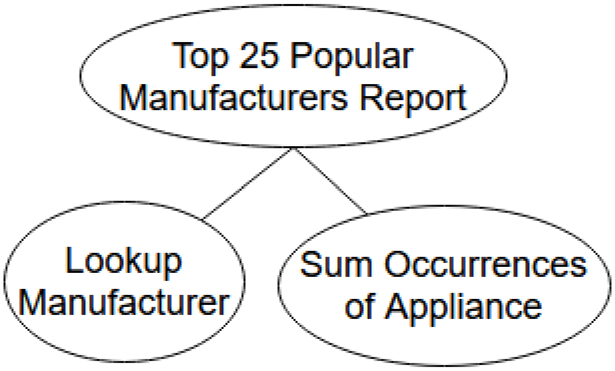
Abstract Code

- Display a table of all appliances types added in the order in which they were added (appliance ID) as well the manufacturer and model
- User responds if they want to ***Add another appliance***
  - When ***Add Another Appliance*** is selected:
    - Return to the beginning of **Appliance Form**
  - When ***Next*** is selected:
    - Continue to Done Screen

Top 25 Popular Manufacturers Report

Task Decomp

Lock Types: Lookup and read-lock on Manufacturer and Appliance.
Number of Locks: Two schema constructs
Enabling Conditions: Choosing this report after clicking “View reports”.
Frequency:
Consistency (ACID): Not critical.
Subtasks: Mother task is needed, not order is not necessary.


Top 25 Popular Manufacturers Report
Lookup Manufacturer
Sum Occurrences of Appliance

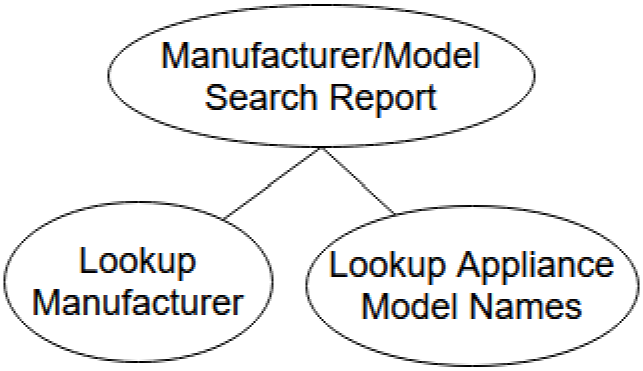
Abstract Code

- Show a summary of each manufacturer’s total count of appliances recorded by users so far, but limited to the top 25 (No parameters are needed, and thus no use-input data validation is needed)
- *User selects (‘$Manufacturer Name’)* from a drop-down list of all manufacturers recognized.
  - This must be found in the existing appliances records made so far to show any data, otherwise show a message “No data has been found for your request.”.
- Show a summary for each appliance type, such as cooker, and TV, the total records made by users, for the specific (‘$Manufacturer Name’) specified.

Manufacturer/Model Search Report

Task Decomp

Lock Types: Lookup and read-lock on Manufacturer and Appliance.
Number of Locks: Two schema constructs
Enabling Conditions: Choosing this report after clicking “View reports”.
Frequency:
Consistency (ACID): Not critical.
Subtasks: Mother task is needed to handle aggregation, and order is not necessary.


Manufacturer/Model Search Report
Lookup Manufacturer
Lookup Appliance Model Names

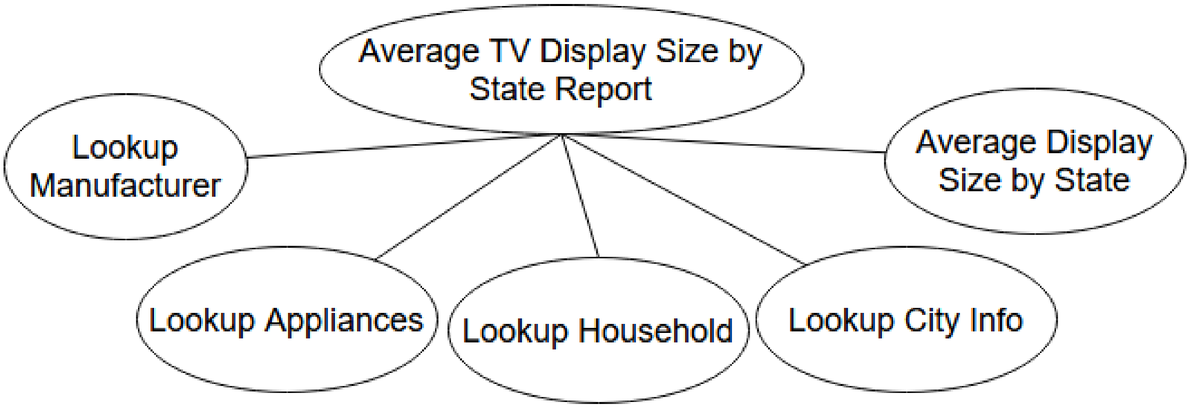
Abstract Code

- *User enters (‘$Search Parameter’)*
    - The parsed (lower-case) result of the (‘$Search Parameter’) must be found in the existing appliances model name or the manufacturer name, recognized in the database to show any data. Otherwise show the message “No data has been found for your request.”.
- Show all the recognized manufacturer name and model name pair, where the parsed (lower-case) result of the (‘$Search Parameter’) matches with either the manufacturer name and/or the model name.
    - The data would be organized so that the manufacturer name and the model name are in alphabetical order, with higher priority on manufacturer.

Average TV Display Size by State Report

Task Decomp

Lock Types: Lookup and read-lock on TV, Appliances, Household and City Info.
Number of Locks: Several different schema constructs are needed.
Enabling Conditions: Choosing this report after clicking “View reports”.
Frequency:
Consistency (ACID): Not critical.
Subtasks: Mother task is needed to handle aggregation, and order is not necessary.


Average TV Display Size by State Report
Lookup Manufacturer
Average Display Size by State
Lookup Appliances
Lookup Household
Lookup City Info

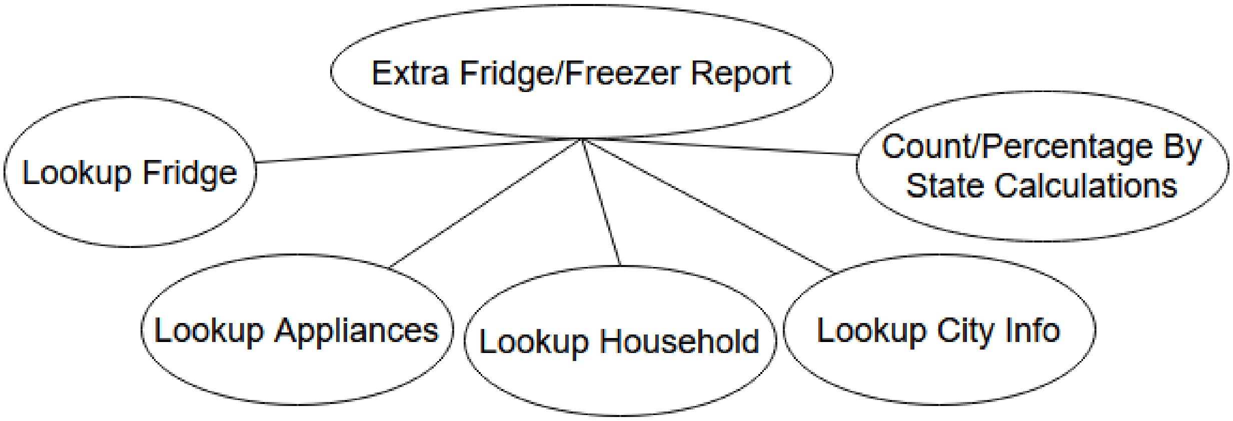
Abstract Code

- Display the summary for the average tv size for each of the states.
    - The average tv size would be rounded to the nearest tenths decimal
    - The data would be organized by the name of the state in an alphabetical order.
- User selects a (‘$State’) from a drop-down of all states.
    - At least 1 tv must be registered in the selected state to show any data, otherwise show the message “No data has been found for the selected state.”.
- Display the average tv size for each screen type and maximum resolution, for the specified (‘$State’).

Extra Fridge/Freezer Report

Task Decomp

Lock Types: Lookup and read-lock on Fridge, Appliances, Household and City Info.
Number of Locks: Several different schema constructs are needed.
Enabling Conditions: Choosing this report after clicking "View reports".
Frequency:
Consistency (ACID): Not critical.
Subtasks: Mother task is needed to handle aggregation, and order is not necessary.


Extra Fridge/Freezer Report
Lookup Fridge
Count/Percentage By State Calculations
Lookup Appliances
Lookup Household
Lookup City Info

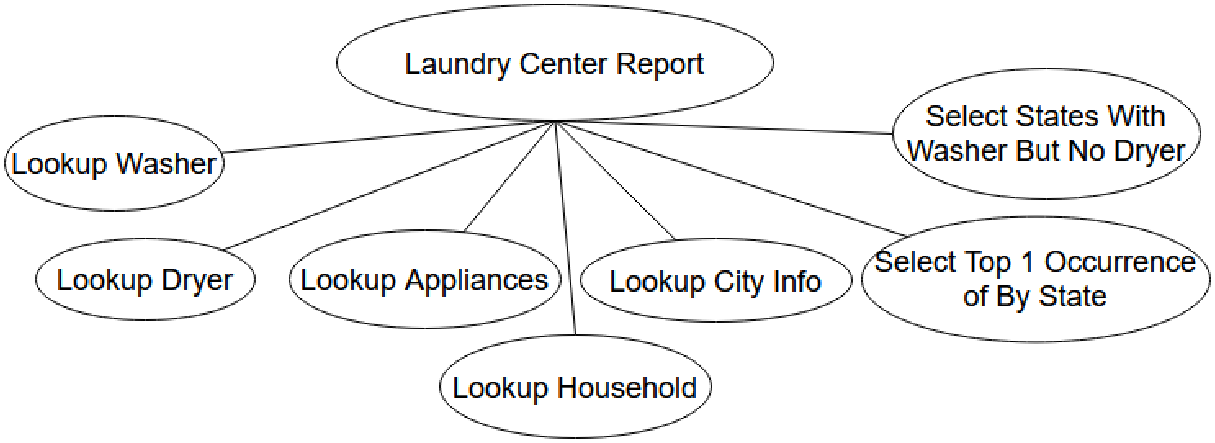
Abstract Code

- Show sum of all the households that have more than 1 bathroom in their house.
- Show a summary of households that have more than 1 bathroom in their house, for each state.
  - The data would be organized from the states with the most number of households that have more than 1 bathroom, to the least.
  - The output will only show the upper 10 in this ranking, and anything below would be not displayed.
  - In addition to the state, and count of households with more than 1 bathrooms, we would also report:
    - the percentage of households with multiple fridge/freezers in that state with chest freezers
    - the percentage of households with multiple fridge/freezers in that state with an upright freezer
    - the percentage of households with multiple fridge/freezers in that state with something else.
      - Which all of them would be rounded to the nearest integer.

Laundry Center Report

Task Decomp

Lock Types: Lookup and read-lock on Washer, Dryer, Appliances, Household and City Info.
Number of Locks: Several different schema constructs are needed.
Enabling Conditions: Choosing this report after clicking “View reports”.
Frequency:
Consistency (ACID): Not critical.
Subtasks: Mother task is needed to handle aggregation, and order is not necessary.



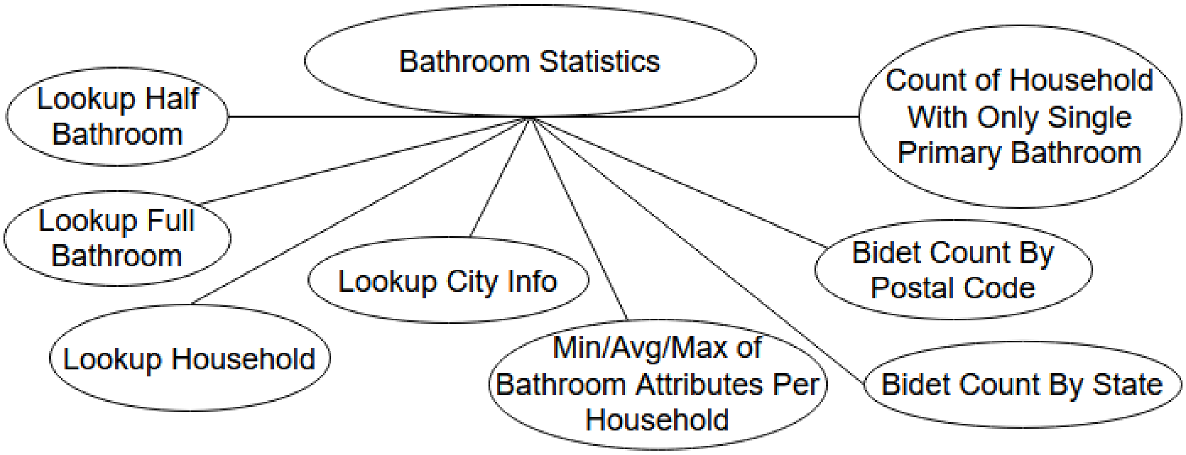
Abstract Code

- Show most common (with the highest count values) loading type and heat source for each state
  - The data would be organized by showing the states in alphabetical order.
- Show the summary of the household count with washing machine but no dryer for each state
  - The data would be organized by ordering the counts high to low. (States with the most households with washing machines, without a dryer, would come first.)

Bathroom Statistics Report

Task Decomp

Lock Types: Lookup and read-lock on Washer, Dryer, Appliances, Household and City Info.
Number of Locks: Several different schema constructs are needed.
Enabling Conditions: Choosing this report after clicking “View reports”.
Frequency:
Consistency (ACID): Not critical.
Subtasks: Mother task is needed to handle aggregation, and order is not necessary.


Bathroom Statistics
Lookup Half Bathroom
Lookup Full Bathroom
Lookup Household
Lookup City Info
Min/Avg/Max of Bathroom Attributes Per Household
Count of Household With Only Single Primary Bathroom
Bidet Count By Postal Code
Bidet Count By State

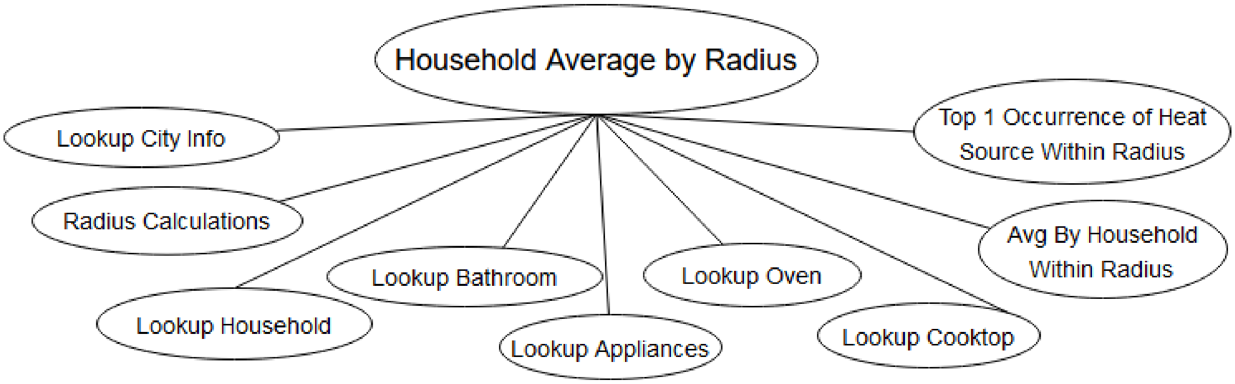
Abstract Code

- Show aggregate information (min, max, avg) of count of all bathrooms per household
- Show aggregate information (min, max, avg) of count of half bathrooms per household
- Show aggregate information (min, max, avg) of count of full bathrooms per household
- Show aggregate information (min, max, avg) of count of commodes per household
- Show aggregate information (min, max, avg) of count of sinks per household
- Show aggregate information (min, max, avg) of count of bidet per household
- Show aggregate information (min, max, avg) of count of bathtubs per household
- Show aggregate information (min, max, avg) of count of showers per household
- Show aggregate information (min, max, avg) of count of tub/showers per household
- State with most bidet and its count
- Postal code with most bidets and its count
- Count of households with one primary full bathroom and none of the other.

Household Averages by Radius Report

Task Decomp

Lock Types: Lookup and read-lock on Oven, Cooktop, Cooker, Appliances, Household, City Info and Bathroom.
Number of Locks: Several different schema constructs are needed.
Enabling Conditions: Choosing this report after clicking "View reports".
Frequency:
Consistency (ACID): Not critical.
Subtasks: Mother task is needed to handle aggregation, and order is necessary to ensure radius is calculated before aggregation.



Abstract Code

- User inputs ('$Center Postal Code')
  - The ('$Center Postal Code') must be found in the postal code/city table, otherwise throw an error " The postal code specified is invalid."
- User inputs ('$Radius') from a drop-down menu of (0, 5, 10, 25, 50, 100, 250).
- Show all of the entries from households that are located within ('$Radius') miles from ('$Center Postal Code') using the haversine within the DB.
  - Show aggregate of average bathroom count per household
  - Show aggregate of average occupant count per household
  - Show aggregate of average ratio between commodes vs occupants
  - Show aggregate of average appliances count per household
  - Show aggregate of average appliances count where the appliance has a heat source.