NANYANG TECHNOLOGICAL UNIVERSITY
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CZ3005 Artificial Intelligence

Lab Assignment 3: Implementing a Talking Box with Prolog

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Question 3: Subway Sandwich Interactor

The Prolog script offers different meal options, sandwich options, meat options, salad options, sauce options, top-up options, sides options etc. to create a customized list of person's choice. The options should be intelligently selected based on previous choices. For example, if the person chose a veggie meal, meat options should not be offered. If a person chose healthy meal, fatty sauces should not be offered. If a person chose vegan meal, cheese top-up should not be offered. If a person chose value meal, no top-up should be offered.

Run the Program

Type these: ['Neo_Rui_Xuan_Berlynn_qn_3.pl']. -> order.

Flow of Program

In the Prolog script I have created, there are 10 meal types – veggie, healthy, vegan, regular, salad, veggie_value, healthy_value, vegan_value, regular_value and salad_value.

The program first asks for the meal type. The choices for each meal type are as follows:

- Veggie: bread, cheese, vegetables, sauce, veggie top up, sides, cookie/chips, drinks
- Healthy: bread, meat, cheese, vegetables, healthy sauce, top up, cookie, healthy drinks
- Vegan: bread, vegetables, sauce, vegan top up, sides, cookie/chips, drinks
- Regular: bread, meat, cheese, vegetables, sauce, top up, sides, cookie/chips, drinks
- Salad: meat, cheese, vegetables, sauce, top up, sides, cookie/chips, drinks
- Veggie Value: bread, cheese, vegetables, sauce, sides, cookie/chips, drinks
- Healthy Value: bread, meat, cheese, vegetables, healthy sauce, cookie, healthy drinks
- Vegan Value: bread, vegetables, sauce, sides, cookie/chips, drinks
- Regular Value: bread, meat, cheese, vegetables, sauce, sides, cookie/chips, drinks
- Salad Value: meat, cheese, vegetables, sauce, sides, cookie/chips, drinks

This fulfils the question in that (1) veggie meals will not have meat options, (2) healthy meals will not have unhealthy sauce, unhealthy drink options or chips as sides, (3) vegan meals will not have meat or cheese options, (4) salad will not have bread option and (5) value meals will not have top up options.

Program design

First, the predicates are defined at the start of the program and defined as dynamic to let the system know that the predicates may change during execution using *assertz* and *retractall*.

```
/* Subway Sandwich Interactor */

:- style_check(-singleton).

:- dynamic meal_type/1, bread/1, meat/1, cheese/1, vegetables/1, sauce/1, healthy_sauce/1, top_up/1, veggie_top_up/1, vegan_top_up/1, sides/1,
cookie_flav/1, chips_type/1, drinks/1, healthy_drinks/1.


/* Definitions */
meal_type([veggie, healthy, vegan, regular, salad, veggie_value, healthy_value, vegan_value, regular_value, salad_value]).
bread([italian_wheat, hearty_italian, honey_oat, parmesan_oregano, multigrain, flatbread]).
meat([turkey, beef, chicken, salami, pepperoni, meatballs, ham, tuna, none]).
cheese([processed_cheddar, monterey_cheddar, none]).
vegetables([cucumbers, green_bell_peppers, lettuce, red_onions, tomatoes, black_olives, jalapenos, pickles, none]).
sauce([chipotle_southwest, ranch, bbq, chilli_sauce, tomato_sauce, mayonnaise, none]).
healthy_sauce([chilli_sauce, tomato_sauce, none]).
top_up([avocado, more_cheese, more_meat, none]).
veggie_top_up([avocado, more_cheese, none]).
vegan_top_up([avocado, none]).
sides([cookie, chips]).
cookie_flav([chocolate_chip, double_chocolate_chip, peanut_butter, white_chip_macademia, oatmeal_raisin, raspberry_cheesecake]).
chips_type([lays_original, lays_bbq, lays_sourcream, ruffles_original]).
drinks([coke, sprite, green_tea, orange_juice]).
healthy_drinks([green_tea, orange_juice]).
```

Figure 1: Definitions

The code for running main program is shown below in *Figure 2*. Please refer to this figure to refresh your mind if you get confused in the further segments.

```
/* Run the program */
order :- write("  ___ _    _ _____        _____     __\n"),
         write("/ __| | | | _ ) \\     / /_\\ \\   / /\n"),
         write("\\__ \\ |_| | _ \\ \\/\\/ / _ \\ \\/ / \n"),
         write("|___/\\___/|___/ \\_/\\_/_/ \\_\\__|  \n\n"),
         ask_meal_type,
         meal_type(Meal_Type),
         (   (Meal_Type == veggie) -> veggie_option,
                                      ask_veggie_top_up,
                                      ask_sides,
                                      get_sides,
                                      ask_drinks,
                                      display_veggie;
             (Meal_Type == healthy) -> healthy_option,
                                       ask_top_up,
                                       sides_cookie,
                                       ask_healthy_drinks,
                                       display_healthy;
             (Meal_Type == vegan) -> vegan_option,
                                     ask_vegan_top_up,
                                     ask_sides,
                                     get_sides,
                                     ask_drinks,
                                     display_vegan;
             (Meal_Type == regular) -> regular_option,
                                       ask_top_up,
                                       ask_sides,
                                       get_sides,
                                       ask_drinks,
                                       display_regular;
             (Meal_Type == salad) -> salad_option,
                                     ask_top_up,
                                     ask_sides,
                                     get_sides,
                                     ask_drinks,
                                     display_salad;
             (Meal_Type == veggie_value) -> veggie_option,
                                            ask_sides,
                                            get_sides,
                                            ask_drinks,
                                            display_veggie_value;
             (Meal_Type == healthy_value) -> healthy_option,
                                             sides_cookie,
                                             ask_healthy_drinks,
                                             display_healthy_value;
             (Meal_Type == vegan_value) -> vegan_option,
                                           ask_sides,
                                           get_sides,
                                           ask_drinks,
                                           display_vegan_value;
             (Meal_Type == regular_value) -> regular_option,
                                             ask_sides,
                                             get_sides,
                                             ask_drinks,
                                             display_regular_value;
             (Meal_Type == salad_value) -> salad_option,
                                           ask_sides,
                                           get_sides,
                                           ask_drinks,
                                           display_salad_value),
         write("**************************************\n"),
         write("See you again!"),
         clear.
```

*Figure 2: Main Program *Segment highlighted for easier reference*

In the main program, the user is first asked about the meal type.

```
ask_meal_type :- write("**************************************\n"),
                 write("What type of meal would you like?\n"),
                 show_all_meal_type(meal_type),
                 read_input_meal_type.
```

Figure 3: ask_meal_type rule

The input is read and put into an IF-THEN-ELSEIF clause as shown below in *Figure 4*, where each meal type will be directed to different questions.

```
/* Run the program */
order :- write(" ___ _   _ _____      _____     __\n"),
         write("/ __| | | | _ ) \\    / /_\\ \\  / /\n"),
         write("\\__ \\ |_| | _ \\\\ \\/\\/ / _ \\ \\/ / \n"),
         write("|___/\\___/|___/ \\_/\\_/_/ \\_\\\\__|  \n\n"),
         ask_meal_type,
         meal_type(Meal_Type),
         (   (Meal_Type == veggie) -> veggie_option,
                                      ask_veggie_top_up,
                                      ask_sides,
                                      get_sides,
                                      ask_drinks,
                                      display_veggie;
             (Meal_Type == healthy) -> healthy_option,
                                       ask_top_up,
                                       sides_cookie,
                                       ask_healthy_drinks,
                                       display_healthy;
             (Meal_Type == vegan) -> vegan_option,
```

Figure 4: Snippet of Figure 2

The sandwich options are defined as *xxx_option* below in *Figure 5*. As the sides, top ups and drinks are asked differently to each meal type in the figure above, there is no need to write out options for every single meal type. Furthermore, for non-healthy meal types, the user has to choose between cookie and chips for sides, so it would be optimal to separate it from the sandwich options.

```
/* Questions depending on meal type */
veggie_option :- ask_bread, ask_cheese, ask_vegetables, ask_sauce.
healthy_option :- ask_bread, ask_meat, ask_cheese, ask_vegetables, ask_healthy_sauce.
vegan_option :- ask_bread, ask_vegetables, ask_sauce.
regular_option :- ask_bread, ask_meat, ask_cheese, ask_vegetables, ask_sauce.
salad_option :- ask_meat, ask_cheese, ask_vegetables, ask_sauce.
sides_cookie :- ask_cookie_flav.
sides_chips :- ask_chips_type.
```

Figure 5: Various sandwich options

In each rule, other rules *ask_xxx* are called as shown below in *Figure 6*. They are questions for each ingredient option. The separation of the ingredients makes it easier to cater to each *xxx_option* as shown above in *Figure 5*.

```
/* Question for each category */
ask_meal_type :- write("************************************\n"),
                 write("What type of meal would you like?\n"),
                 show_all_meal_type(meal_type),
                 read_input_meal_type.
ask_bread :- write("************************************\n"),
             write("What bread would you like?\n"),
             show_all_bread(bread),
             read_input_bread.
ask_meat :- write("************************************\n"),
            write("What meat would you like?\n"),
            show_all_meat(meat),
            read_input_meat.
ask_cheese :- write("************************************\n"),
              write("What cheese would you like?\n"),
              show_all_cheese(cheese),
              read_input_cheese.
ask_vegetables :- write("************************************\n"),
                  write("What vegetables would you like?\n"),
                  show_all_vegetables(vegetables),
                  read_input_vegetables.
ask_sauce :- write("************************************\n"),
             write("What sauce would you like?\n"),
             show_all_sauce(sauce),
             read_input_sauce.
ask_healthy_sauce :- write("************************************\n"),
                     write("What sauce would you like?\n"),
                     show_all_healthy_sauce(healthy_sauce),
                     read_input_healthy_sauce.
ask_top_up :- write("************************************\n"),
              write("What top-ups would you like?\n"),
              show_all_top_up(top_up),
              read_input_top_up.
ask_veggie_top_up :- write("************************************\n"),
                     write("What top-ups would you like?\n"),
                     show_all_veggie_top_up(veggie_top_up),
                     read_input_veggie_top_up.
ask_vegan_top_up :- write("************************************\n"),
                    write("What top-ups would you like?\n"),
                    show_all_vegan_top_up(vegan_top_up),
                    read_input_vegan_top_up.
ask_sides :- write("************************************\n"),
             write("What sides would you like?\n"),
             show_all_sides(sides),
             read_input_sides.
ask_cookie_flav :- write("************************************\n"),
                   write("What cookie flavour would you like?\n"),
                   show_all_cookie_flav(cookie_flav),
                   read_input_cookie_flav.
ask_chips_type :- write("************************************\n"),
                  write("What chips would you like?\n"),
                  show_all_chips_type(chips_type),
                  read_input_chips_type.
ask_drinks :- write("************************************\n"),
              write("What drinks would you like?\n"),
              show_all_drinks(drinks),
              read_input_drinks.
ask_healthy_drinks :- write("************************************\n"),
                      write("What drinks would you like?\n"),
                      show_all_healthy_drinks(healthy_drinks),
                      read_input_healthy_drinks.
```

Figure 6: Questions for each ingredient option

- The rule *show_all_xxx* displays all choices for each ingredient option from *ask_xxx* with the help of *list_items/1*.

```
/* Display all possible choices */
show_all_meal_type(meal_type) :- meal_type(L), write("Meal types: \n"), list_items(L).
show_all_bread(bread) :- bread(L), write("Bread: \n"), list_items(L).
show_all_meat(meat) :- meat(L), write("Meat: \n"), list_items(L),
                       write("* More than one meat can be chosen.\n").
show_all_cheese(cheese) :- cheese(L), write("Cheese: \n"), list_items(L).
show_all_vegetables(vegetables) :- vegetables(L), write("Vegetables: \n"), list_items(L),
                                   write("* More than one vegetable can be chosen.\n").
show_all_sauce(sauce) :- sauce(L), write("Sauces: \n"), list_items(L).
show_all_healthy_sauce(healthy_sauce) :- healthy_sauce(L), write("Sauces: \n"), list_items(L).
show_all_top_up(top_up) :- top_up(L), write("Top-ups: \n"), list_items(L),
                           write("* More than one top-up can be chosen.\n").
show_all_veggie_top_up(veggie_top_up) :- veggie_top_up(L), write("Top-ups: \n"), list_items(L),
                                         write("* More than one top-up can be chosen.\n").
show_all_vegan_top_up(vegan_top_up) :- vegan_top_up(L), write("Top-ups: \n"), list_items(L).
show_all_sides(sides) :- sides(L), write("Sides: \n"), list_items(L).
show_all_cookie_flav(cookie_flav) :- cookie_flav(L), write("Cookie Flavours: \n"), list_items(L).
show_all_chips_type(chips_type) :- chips_type(L), write("Chips: \n"), list_items(L).
show_all_drinks(drinks) :- drinks(L), write("Drinks: \n"), list_items(L).
show_all_healthy_drinks(healthy_drinks) :- healthy_drinks(L), write("Drinks: \n"), list_items(L).

list_items(X) :- X=[A|B], write("- "), write(A), nl, list_items(B).
list_items([]).
```

Figure 7: Display all possible choices

- The rule *read_input_xxx* (*Figure 8*) reads the input after each question from *ask_xxx*. If the *check/2* rule in *Figure 9* checks that it is a valid input, *assertz/1* will be carried out on the corresponding dynamic predicate and update it. If an invalid input is entered, the user will be prompted to re-enter again as the rule is called again in the ELSE clause.

```
/* Read input from each question */
read_input_meal_type :- read(X),
                        check(X, meal_type) -> assertz(meal_type(X));
                        write("Invalid input. Please try again.\n"), read_input_meal_type.
read_input_bread :- read(X),
                    check(X, bread) -> assertz(bread(X));
                    write("Invalid input. Please try again.\n"), read_input_bread.
read_input_meat :- read(X),
                   (not(X == x) ->
                        (check(X, meat) -> write("Click x if you don't want to add anymore meat.\n"), assertz(meat(X));
                        write("Invalid input. Please try again.\n")), read_input_meat;
                        true).
read_input_cheese :- read(X),
                     check(X, cheese) -> assertz(cheese(X));
                     write("Invalid input. Please try again.\n"), read_input_cheese.
read_input_vegetables :- read(X),
                         (not(X == x) ->
                            (check(X, vegetables) -> write("Click x if you don't want to add anymore vegetables.\n"), assertz(vegetables(X));
                            write("Invalid input. Please try again.\n")), read_input_vegetables;
                            true).
read_input_sauce :- read(X),
                    check(X, sauce) -> assertz(sauce(X));
                    write("Invalid input. Please try again.\n"), read_input_sauce.
read_input_healthy_sauce :- read(X),
                            check(X, healthy_sauce) -> assertz(healthy_sauce(X));
                            write("Invalid input. Please try again.\n"), read_input_healthy_sauce.
read_input_top_up :- read(X),
                     (not(X == x) ->
                        (check(X, top_up) -> write("Click x if you don't want to add anymore top-ups.\n"), assertz(top_up(X));
                        write("Invalid input. Please try again.\n")), read_input_top_up;
                        true).
read_input_veggie_top_up :- read(X),
                            (not(X == x) ->
                            (check(X, veggie_top_up) -> write("Click x if you don't want to add anymore top-ups.\n"), assertz(veggie_top_up(X))
;
                            write("Invalid input. Please try again.\n")), read_input_veggie_top_up;
                            true).
read_input_vegan_top_up :- read(X),
                           check(X, vegan_top_up) -> assertz(vegan_top_up(X));
                           write("Invalid input. Please try again.\n"), read_input_vegan_top_up.
read_input_sides :- read(X),
                    check(X, sides) -> assertz(sides(X));
                    write("Invalid input. Please try again.\n"), read_input_sides.
read_input_cookie_flav :- read(X),
                          check(X, cookie_flav) -> assertz(cookie_flav(X));
                          write("Invalid input. Please try again.\n"), read_input_cookie_flav.
read_input_chips_type :- read(X),
                         check(X, chips_type) -> assertz(chips_type(X));
                         write("Invalid input. Please try again.\n"), read_input_chips_type.
read_input_drinks :- read(X),
                     check(X, drinks) -> assertz(drinks(X));
                     write("Invalid input. Please try again.\n"), read_input_drinks.
read_input_healthy_drinks :- read(X),
                             check(X, healthy_drinks) -> assertz(healthy_drinks(X));
                             write("Invalid input. Please try again.\n"), read_input_healthy_drinks.
```

Figure 8: Read input from each question

  - For each ingredient option, the *check/2* rule checks if the input matches the words in the definition by checking if the input is a member of the defined list.

```
/* Check if input match words in definition */
check(X, meal_type) :- meal_type(Y), member(X, Y).
check(X, bread) :- bread(Y), member(X, Y).
check(X, meat) :- meat(Y), member(X, Y).
check(X, cheese) :- cheese(Y), member(X, Y).
check(X, vegetables) :- vegetables(Y), member(X, Y).
check(X, sauce) :- sauce(Y), member(X, Y).
check(X, healthy_sauce) :- healthy_sauce(Y), member(X, Y).
check(X, top_up) :- top_up(Y), member(X, Y).
check(X, veggie_top_up) :- veggie_top_up(Y), member(X, Y).
check(X, vegan_top_up) :- vegan_top_up(Y), member(X, Y).
check(X, sides) :- sides(Y), member(X, Y).
check(X, cookie_flav) :- cookie_flav(Y), member(X, Y).
check(X, chips_type) :- chips_type(Y), member(X, Y).
check(X, drinks) :- drinks(Y), member(X, Y).
check(X, healthy_drinks) :- healthy_drinks(Y), member(X, Y).
```

Figure 9: check/2 rule

  - For ingredient options that accept at least one input, i.e. meat, vegetables, top up and veggie top up, there is a “loop” created by calling the same *read_xxx* rule again. This will allow the user to enter more inputs until they enter “x”, which will cause them to go out of the “loop” as (*X == x*). *true* is used at the end to always succeed.

```
read_input_meat :- read(X),
                   (not(X == x) ->
                        (check(X, meat) -> write("Click x if you don't want to add anymore meat.\n"), assertz(meat(X));
                        write("Invalid input. Please try again.\n")), read_input_meat;
                        true).
```

Figure 10: Snippet of Figure 8 – ingredient options accepting multiple inputs

After the user is done with their individual option (e.g. *regular_option* for *Meal_Type == regular*), the user is asked whether they want a top-up if they are having a non-value meal.

```
ask_top_up :- write("************************************\n"),
              write("What top-ups would you like?\n"),
              show_all_top_up(top_up),
              read_input_top_up.
ask_veggie_top_up :- write("************************************\n"),
              write("What top-ups would you like?\n"),
              show_all_veggie_top_up(veggie_top_up),
              read_input_veggie_top_up.
ask_vegan_top_up :- write("************************************\n"),
              write("What top-ups would you like?\n"),
              show_all_vegan_top_up(vegan_top_up),
              read_input_vegan_top_up.
```

Figure 11: Snippet of Figure 6 - Prompt user for top-up

If the user has a value meal, or if they are done with the top up option, they will be prompted to choose their sides.

```
ask_sides :- write("************************************\n"),
             write("What sides would you like?\n"),
             show_all_sides(sides),
             read_input_sides.
```

Figure 12: Snippet of Figure 6 - Prompt user to choose sides

If they are having a healthy meal, they will only be prompted to choose their cookie and then their drink.

```
(Meal_Type == healthy) -> healthy_option,
                          ask_top_up,
                          sides_cookie,
                          ask_healthy_drinks,
                          display_healthy;
```

```
(Meal_Type == healthy_value) -> healthy_option,
                                sides_cookie,
                                ask_healthy_drinks,
                                display_healthy_value;
```

Figure 13: Snippet of Figure 2

- After the user chooses their sides, the sides choice is passed to *get_sides*, and they will be redirected to choose either chips or cookies based on their sides choice using an IF-THEN-ELSEIF clause.

```
get_sides :- sides(Sides),
             ((Sides == chips) -> sides_chips;
              (Sides == cookie) -> sides_cookie).
```

```
sides_cookie :- ask_cookie_flav.
sides_chips :- ask_chips_type.
```

```
ask_cookie_flav :- write("************************************\n"),
                   write("What cookie flavour would you like?\n"),
                   show_all_cookie_flav(cookie_flav),
                   read_input_cookie_flav.
ask_chips_type :- write("************************************\n"),
                  write("What chips would you like?\n"),
                  show_all_chips_type(chips_type),
                  read_input_chips_type.
```

Figure 14: get_sides rule, and Snippet of Figure 5 and 6 respectively

Next, the user will be prompted to choose their drinks, or healthy drinks if they opted for a healthy meal using the rule *ask_drinks* and *ask_healthy_drinks* respectively.

```
ask_drinks :- write("************************************\n"),
              write("What drinks would you like?\n"),
              show_all_drinks(drinks),
              read_input_drinks.
```

```
ask_healthy_drinks :- write("************************************\n"),
                      write("What drinks would you like?\n"),
                      show_all_healthy_drinks(healthy_drinks),
                      read_input_healthy_drinks.
```

Figure 15: Snippet of Figure 6

Lastly, the user will receive an overview of what they ordered using the rule *display_xxx* that gets the selected options with the help of *get_selected/15*. The *findall/3* rule (e.g. *findall*(*X, meal_type*(*X*), *MMeal_Type*)) produces a list of objects that fulfil the *meal_type*(*X*) rule. *MMeal_Type* will contain a list of the defined predicates from the start of the program and also the user's input.

```
get_selected(MMeal_Type, MBread, MMeat, MCheese, MVegetables, MSauce, MHealthy_Sauce, MTop_Up, MVeggie_Top_Up, MVegan_Top_Up, MSides, MCookie_F
lav, MChips_Type, MDrinks, MHealthy_Drinks):-
    findall(X, meal_type(X), MMeal_Type),
    findall(X, bread(X), MBread),
    findall(X, meat(X), MMeat),
    findall(X, cheese(X), MCheese),
    findall(X, vegetables(X), MVegetables),
    findall(X, sauce(X), MSauce),
    findall(X, healthy_sauce(X), MHealthy_Sauce),
    findall(X, top_up(X), MTop_Up),
    findall(X, veggie_top_up(X), MVeggie_Top_Up),
    findall(X, vegan_top_up(X), MVegan_Top_Up),
    findall(X, sides(X), MSides),
    findall(X, cookie_flav(X), MCookie_Flav),
    findall(X, chips_type(X), MChips_Type),
    findall(X, drinks(X), MDrinks),
    findall(X, healthy_drinks(X), MHealthy_Drinks).
```

Figure 16: get_selected rule

As there are *display_xxx* rules for every meal type, I will be showing *display_regular* only, because it shows most of the ingredients.

```
display_regular :- get_selected(MMeal_Type, MBread, MMeat, MCheese, MVegetables, MSauce, MHealthy_Sauce, MTop_Up, MVeggie_Top_Up, MVegan_Top_Up
, MSides, MCookie_Flav, MChips_Type, MDrinks, MHealthy_Drinks),
    write("************************************\n"),
    write("Your order is: \n"),
    append(_, [Meal_Type], MMeal_Type),
       write("Meal Type: ["), write(Meal_Type), write("]"), nl,
    append(_, [Bread], MBread),
       write("Bread: ["), write(Bread), write("]"), nl,
    subtract(MMeat, [Meat], M),
       sort(M, SortM),
       write("Meat: "), write(SortM), nl,
    append(_, [Cheese], MCheese),
       write("Cheese: ["), write(Cheese), write("]"), nl,
    subtract(MVegetables, [Vegetables], L),
       sort(L, SortL),
       write("Vegetables: "), write(SortL), nl,
    append(_, [Sauce], MSauce),
       write("Sauce: ["), write(Sauce), write("]"), nl,
    subtract(MTop_Up, [Top_Up], T),
       sort(T, SortT),
       write("Top-ups: "), write(SortT), nl,
    append(_, [Sides], MSides),
    ((Sides == cookie) -> append(_, [Cookie_Flav], MCookie_Flav),
       write("Cookie: ["), write(Cookie_Flav), write("]"), nl;
     (Sides == chips) -> append(_, [Chips_Type], MChips_Type),
       write("Chips: ["), write(Chips_Type), write("]"), nl),
    append(_, [Drinks], MDrinks),
       write("Drinks: ["), write(Drinks), write("]"), nl.
```

Figure 17: display_regular rule

- For the ingredient options that could accept multiple inputs (snippet below in *Figure 17*), I made use of *subtract/3* by subtracting the old list from the new list to get the latest list of inputs.
  e.g. When I select both *avocado* and *more_cheese* for top-ups,
  MTop_Up = [[*avocado, more_cheese, more_meat, none*], *avocado*, *more_cheese*],
  Top_up = [*avocado, more_cheese, more_meat, none*],
  T = [*avocado, more_cheese*]
  I also used *sort/2* to remove duplicate inputs.

```
subtract(MTop_Up, [Top_Up], T),
   sort(T, SortT),
   write("Top-ups: "), write(SortT), nl,
```

Figure 18: How I display for ingredient options that accept multiple inputs – e.g. top-ups

- For the remaining ingredient options, I made use of *append/3* (e.g. *append(_, [Sauce], MSauce*), to get the last element of the list (i.e. the user input, and it is stored in *Sauce*).

```
append(_, [Sauce], MSauce),
   write("Sauce: ["), write(Sauce), write("]"), nl,
```

Figure 19: How I display for ingredient options that accept one input – e.g. Sauce

- For the sides, cookie and chips, the order displayed is based on the user's input of *Sides* to determine which sides will be displayed using an IF-THEN-ELSEIF clause.

```
append(_, [Sides], MSides),
((Sides == cookie) -> append(_, [Cookie_Flav], MCookie_Flav),
   write("Cookie: ["), write(Cookie_Flav), write("]"), nl;
 (Sides == chips) -> append(_, [Chips_Type], MChips_Type),
   write("Chips: ["), write(Chips_Type), write("]"), nl),
```

Figure 20: How I display for sides of cookie or chips

At the end of the program, the clear rule is carried out where every *retractall/1* is carried out on each dynamic predicate.

```
/* Clear dynamic predicates */
clear :- retractall(meal_type(_)),
         retractall(bread(_)),
         retractall(meat(_)),
         retractall(cheese(_)),
         retractall(vegetables(_)),
         retractall(sauce(_)),
         retractall(healthy_sauce(_)),
         retractall(top_up(_)),
         retractall(veggie_top_up(_)),
         retractall(vegan_top_up(_)),
         retractall(sides(_)),
         retractall(cookie_flav(_)),
         retractall(chips_type(_)),
         retractall(drinks(_)),
         retractall(healthy_drinks(_)).
```

Figure 21: Clearing all dynamic predicates

Interaction with the program

Veggie Meal Type

```
?- order.

**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: veggie.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: flatbread.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: none.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: cucumbers.
Click x if you don't want to add anymore vegetabl
|: lettuce.
Click x if you don't want to add anymore vegetabl
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: ranch.
**************************************
What top-ups would you like?
Top-ups:
- avocado
- more_cheese
- none
* More than one top-up can be chosen.
|: avocado.
Click x if you don't want to add anymore top-ups
|: x.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: chips.
**************************************
What chips would you like?
Chips:
- lays_original
- lays_bbq
- lays_sourcream
- ruffles_original
|: lays_bbq.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: green_tea.
**************************************
Your order is:
Meal Type: [veggie]
Bread: [flatbread]
Cheese: [none]
Vegetables: [cucumbers,lettuce]
Sauce: [ranch]
Top-ups: [avocado]
Chips: [lays_bbq]
Drinks: [green_tea]
**************************************
See you again!
true .
```

*No meat options

*No meat top-up

Healthy Meal Type

```
?- order.

**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: healthy.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: flatbread.
**************************************
What meat would you like?
Meat:
- turkey
- beef
- chicken
- salami
- pepperoni
- meatballs
- ham
- tuna
- none
* More than one meat can be chosen.
|: chicken.
Click x if you don't want to add anymore meat.
|: ham.
Click x if you don't want to add anymore meat.
|: x.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: monterey_cheddar.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: tomatoes.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chilli_sauce
- tomato_sauce
- none
|: chilli_sauce.
**************************************
What top-ups would you like?
Top-ups:
- avocado
- more_cheese
- more_meat
- none
* More than one top-up can be chosen.
|: none.
Click x if you don't want to add anymore top-ups.
|: x.
**************************************
What cookie flavour would you like?
Cookie Flavours:
- chocolate_chip
- double_chocolate_chip
- peanut_butter
- white_chip_macademia
- oatmeal_raisin
- raspberry_cheesecake
|: peanut_butter.
**************************************
What drinks would you like?
Drinks:
- green_tea
- orange_juice
|: green_tea.
**************************************
Your order is:
Meal Type: [healthy]
Bread: [flatbread]
Meat: [chicken,ham]
Cheese: [monterey_cheddar]
Vegetables: [pickles,tomatoes]
Healthy Sauce: [chilli_sauce]
Top-ups: [none]
Cookie: [peanut_butter]
Healthy Drinks: [green_tea]
**************************************
See you again!
true .
```

*No unhealthy sauce

*No unhealthy drink

*No choice of chips for sides

Vegan Meal Type

```
?- order.

**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: vegan.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: hearty_italian.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: tomatoes.
Click x if you don't want to add anymore vegetables.
|: cucumbers.
Click x if you don't want to add anymore vegetables.
|: lettuce.
Click x if you don't want to add anymore vegetables.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: chipotle_southwest.
**************************************
What top-ups would you like?
Top-ups:
- avocado
- none
|: avocado.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: chips.
**************************************
What chips would you like?
Chips:
- lays_original
- lays_bbq
- lays_sourcream
- ruffles_original
|: lays_original.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: coke.
**************************************
Your order is:
Meal Type: [vegan]
Bread: [hearty_italian]
Vegetables: [cucumbers,lettuce,pickles,tomatoes]
Sauce: [chipotle_southwest]
Top-ups: [avocado]
Chips: [lays_original]
Drinks: [coke]
**************************************
See you again!
true .
```

*No meat options

*No cheese options

*No meat top-up

*No cheese top-up

Regular Meal Type

```
?- order.
 ___ _ _ _____      ____  __
/ __| | | _ ) \    / /_\ \ / /
\__ \ |_| _ \\ \/\/ / _ \ V /
|___/\___/___/ \_/\_/_/ \_\_|

**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: regular.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: parmesan_oregano.
**************************************
What meat would you like?
Meat:
- turkey
- beef
- chicken
- salami
- pepperoni
- meatballs
- ham
- tuna
- none
* More than one meat can be chosen.
|: turkey.
Click x if you don't want to add anymore meat.
|: beef.
Click x if you don't want to add anymore meat.
|: x.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: processed_cheddar.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: cucumbers.
Click x if you don't want to add anymore vegetables.
|: tomatoes.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: mayonnaise.
**************************************
What top-ups would you like?
Top-ups:
- avocado
- more_cheese
- more_meat
- none
* More than one top-up can be chosen.
|: more_meat.
Click x if you don't want to add anymore top-ups.
|: avocado.
Click x if you don't want to add anymore top-ups.
|: x.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: cookie.
**************************************
What cookie flavour would you like?
Cookie Flavours:
- chocolate_chip
- double_chocolate_chip
- peanut_butter
- white_chip_macademia
- oatmeal_raisin
- raspberry_cheesecake
|: raspberry_cheesecake.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: coke.
**************************************
Your order is:
Meal Type: [regular]
Bread: [parmesan_oregano]
Meat: [beef,turkey]
Cheese: [processed_cheddar]
Vegetables: [cucumbers,tomatoes]
Sauce: [mayonnaise]
Top-ups: [avocado,more_meat]
Cookie: [raspberry_cheesecake]
Drinks: [coke]
**************************************
See you again!
true .
```

Salad Meal Type

```
?- order.
 ___ _ _ _____      ____  __
/ __| | | _ ) \    / /_\ \ / /
\__ \ |_| _ \\ \/\/ / _ \ V /
|___/\___/___/ \_/\_/_/ \_\_|

**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: salad.
**************************************
What meat would you like?
Meat:
- turkey
- beef
- chicken
- salami
- pepperoni
- meatballs
- ham
- tuna
- none
* More than one meat can be chosen.
|: meatballs.
Click x if you don't want to add anymore meat.
|: x.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: none.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: green_bell_peppers.
Click x if you don't want to add anymore vegetables.
|: black_olives.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: bbq.
**************************************
What top-ups would you like?
Top-ups:
- avocado
- more_cheese
- more_meat
- none
* More than one top-up can be chosen.
|: none.
Click x if you don't want to add anymore top-ups.
|: x.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: cookie.
**************************************
What cookie flavour would you like?
Cookie Flavours:
- chocolate_chip
- double_chocolate_chip
- peanut_butter
- white_chip_macademia
- oatmeal_raisin
- raspberry_cheesecake
|: white_chip_macademia.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: green_tea.
**************************************
Your order is:
Meal Type: [salad]
Meat: [meatballs]
Cheese: [none]
Vegetables: [black_olives,green_bell_peppers]
Sauce: [bbq]
Top-ups: [none]
Cookie: [white_chip_macademia]
Drinks: [green_tea]
**************************************
See you again!
true .
```

*No bread options

Veggie Value Meal Type

```
?- order.
```

```
**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: veggie_value.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: honey_oat.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: processed_cheddar.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: cucumbers.
Click x if you don't want to add anymore vegetables.
|: jalapenos.
Click x if you don't want to add anymore vegetables.
|: green_bell_peppers.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: bbq.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: chips.
**************************************
What chips would you like?
Chips:
- lays_original
- lays_bbq
- lays_sourcream
- ruffles_original
|: ruffles_original.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: sprite.
**************************************
Your order is:
Meal Type: [veggie_value]
Bread: [honey_oat]
Cheese: [processed_cheddar]
Vegetables: [cucumbers,green_bell_peppers,jalapenos]
Sauce: [bbq]
Chips: [ruffles_original]
Drinks: [sprite]
**************************************
See you again!
true .
```

*No meat options

*No top-up options

Healthy Value Meal Type

```
?- order.
```



```
**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: healthy_value.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: parmesan_oregano.
**************************************
What meat would you like?
Meat:
- turkey
- beef
- chicken
- salami
- pepperoni
- meatballs
- ham
- tuna
- none
* More than one meat can be chosen.
|: ham.
Click x if you don't want to add anymore meat.
|: pepperoni.
Click x if you don't want to add anymore meat.
|: x.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: none.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: tomatoes.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chilli_sauce
- tomato_sauce
- none
|: tomato_sauce.
**************************************
What cookie flavour would you like?
Cookie Flavours:
- chocolate_chip
- double_chocolate_chip
- peanut_butter
- white_chip_macademia
- oatmeal_raisin
- raspberry_cheesecake
|: oatmeal_raisin.
**************************************
What drinks would you like?
Drinks:
- green_tea
- orange_juice
|: orange_juice.
**************************************
Your order is:
Meal Type: [healthy_value]
Bread: [parmesan_oregano]
Meat: [ham,pepperoni]
Cheese: [none]
Vegetables: [pickles,tomatoes]
Healthy Sauce: [tomato_sauce]
Cookie: [oatmeal_raisin]
Drinks: [orange_juice]
**************************************
See you again!
true .
```

*No unhealthy sauce

*No unhealthy drink

*No choice of chips for sides

*No top-up options

Vegan Value Meal Type

```
?- order.
```



```
**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: vegan_value.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: hearty_italian.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: lettuce.
Click x if you don't want to add anymore vegetables.
|: red_onions.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: none.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: chips.
**************************************
What chips would you like?
Chips:
- lays_original
- lays_bbq
- lays_sourcream
- ruffles_original
|: lays_sourcream.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: orange_juice.
**************************************
Your order is:
Meal Type: [vegan_value]
Bread: [hearty_italian]
Vegetables: [lettuce,pickles,red_onions]
Sauce: [none]
Chips: [lays_sourcream]
Drinks: [orange_juice]
**************************************
See you again!
true .
```

*No meat options

*No cheese options

*No top-up options

Regular Value Meal Type

```
?- order.
 ___ _ _ _____ ___ ___ ___
/ __| | | | __| _ \ __| _ \
\__ \ |_| | _||   / _||   /
|___/\___/|___|_|_\___|_|_\|

**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: regular_value.
**************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: multigrain.
**************************************
What meat would you like?
Meat:
- turkey
- beef
- chicken
- salami
- pepperoni
- meatballs
- ham
- tuna
- none
* More than one meat can be chosen.
|: chicken.
Click x if you don't want to add anymore meat.
|: beef.
Click x if you don't want to add anymore meat.
|: turkey.
Click x if you don't want to add anymore meat.
|: x.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: none.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: lettuce.
Click x if you don't want to add anymore vegetables.
|: green_bell_peppers.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: chipotle_southwest.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: cookie.
**************************************
What cookie flavour would you like?
Cookie Flavours:
- chocolate_chip
- double_chocolate_chip
- peanut_butter
- white_chip_macademia
- oatmeal_raisin
- raspberry_cheesecake
|: peanut_butter.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: coke.
**************************************
Your order is:
Meal Type: [regular_value]
Bread: [multigrain]
Meat: [beef,chicken,turkey]
Cheese: [none]
Vegetables: [green_bell_peppers,lettuce,pickles]
Sauce: [chipotle_southwest]
Cookie: [peanut_butter]
Drinks: [coke]
**************************************
See you again!
true .
```

Salad Value Meal Type

```
?- order.
 ___ _ _ _____ ___ ___ ___
/ __| | | | __| _ \ __| _ \
\__ \ |_| | _||   / _||   /
|___/\___/|___|_|_\___|_|_\|

**************************************
What type of meal would you like?
Meal types:
- veggie
- healthy
- vegan
- regular
- salad
- veggie_value
- healthy_value
- vegan_value
- regular_value
- salad_value
|: salad_value.
**************************************
What meat would you like?
Meat:
- turkey
- beef
- chicken
- salami
- pepperoni
- meatballs
- ham
- tuna
- none
* More than one meat can be chosen.
|: ham.
Click x if you don't want to add anymore meat.
|: beef.
Click x if you don't want to add anymore meat.
|: x.
**************************************
What cheese would you like?
Cheese:
- processed_cheddar
- monterey_cheddar
- none
|: monterey_cheddar.
**************************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: lettuce.
Click x if you don't want to add anymore vegetables.
|: x.
**************************************
What sauce would you like?
Sauces:
- chipotle_southwest
- ranch
- bbq
- chilli_sauce
- tomato_sauce
- mayonnaise
- none
|: ranch.
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: chips.
**************************************
What chips would you like?
Chips:
- lays_original
- lays_bbq
- lays_sourcream
- ruffles_original
|: lays_bbq.
**************************************
What drinks would you like?
Drinks:
- coke
- sprite
- green_tea
- orange_juice
|: coke.
**************************************
Your order is:
Meal Type: [salad_value]
Meat: [beef,ham]
Cheese: [monterey_cheddar]
Vegetables: [lettuce,pickles]
Sauce: [ranch]
Chips: [lays_bbq]
Drinks: [coke]
**************************************
See you again!
true .
```

*No bread options

*No top-up options

Other Features

Other Features

Entering item not in list:

```
************************************
What bread would you like?
Bread:
- italian_wheat
- hearty_italian
- honey_oat
- parmesan_oregano
- multigrain
- flatbread
|: bread.
Invalid input. Please try again.
|: flatbread.
************************************
```

Entering duplicate items:

```
**********************************
What vegetables would you like?
Vegetables:
- cucumbers
- green_bell_peppers
- lettuce
- red_onions
- tomatoes
- black_olives
- jalapenos
- pickles
- none
* More than one vegetable can be chosen.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: cucumbers.
Click x if you don't want to add anymore vegetables.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: tomatoes.
Click x if you don't want to add anymore vegetables.
|: black_olives.
Click x if you don't want to add anymore vegetables.
|: cucumbers.
Click x if you don't want to add anymore vegetables.
|: pickles.
Click x if you don't want to add anymore vegetables.
|: x.
**********************************
```

Entering none:

```
**********************************
What meat would you like?
Meat:
- turkey
- beef
- chicken
- salami
- pepperoni
- meatballs
- ham
- tuna
- none
* More than one meat can be chosen.
|: none.
Click x if you don't want to add anymore meat.
|: x
|: .
**********************************
```

Entering sides and then choosing appropriate side:

```
**************************************
What sides would you like?
Sides:
- cookie
- chips
|: cookie.
**************************************
What cookie flavour would you like?
Cookie Flavours:
- chocolate_chip
- double_chocolate_chip
- peanut_butter
- white_chip_macademia
- oatmeal_raisin
- raspberry_cheesecake
|: chocolate_chip.
**************************************
```

Result:

```
****************************************
Your order is:
Meal Type: [regular]
Bread: [flatbread]
Meat: [none]
Cheese: [processed_cheddar]
Vegetables: [black_olives,cucumbers,pickles,tomatoes]
Sauce: [chipotle_southwest]
Top-ups: [avocado]
Cookie: [chocolate_chip]
Drinks: [coke]
****************************************
See you again!
true .
```

- *flatbread* is added to the order.
- All vegetables typed out are included, but no duplicates.
- *Meat* shows *none* in the order.
- *cookie* is chosen for sides and user is brought to the right page and asked about *cookie*.