

MANIPULATION CHALLENGE : FOOD TRAY ASSEMBLY (UPDATES)

A robot must **assemble as many complete food trays** within a set time limit. The robot must use at least one “soft” component, such as but not limited to a gripper, and must be fully autonomous. The food tray **shall contain seven (7) types of food** selected from this list:

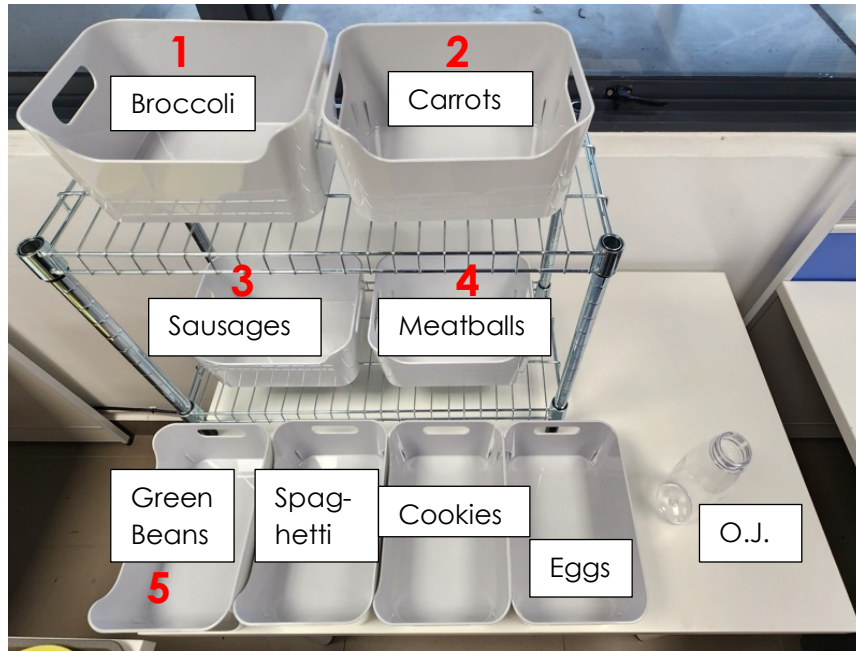
1. Sausages (cooked)
2. Meatballs (cooked)
3. Broccoli (florets, raw)
4. Carrots (sliced, 2-5mm thick, cooked)
5. Green Beans or French String Beans (cooked)
6. Spaghetti Noodles (cooked)
7. Cookies
8. Fried eggs (sunny side up)
9. Surprise Food Item 1 – Snack food locally available in Singapore*
10. Orange juice

*Surprise Food Item has been announced. This surprise food item (#9) will randomly replace other foods in the list (#1-8).

THE PICKING TASK:

In no specific order, a robot must pick food items from one table and place them into particular containers on a tray. The robot may assemble up to 2 complete trays (or more). For every item, please refer to the table below for the quantity, and specific considerations during picking/placing. Teams are allowed to decide on the picking strategy if there are no specific methods identified.

S/N	Item	Quantity	Picking / Placing Requirements or Suggested Strategies
1	Sausages	5 pcs	Up to the team
2	Meatballs	5 pcs	Up to the team; the food must remain intact (in shape or constitution) after placing
3	Broccoli	5 pcs	Up to the team
4	Carrots	5 slices	Up to the team
5	Green beans	5 pcs	Up to the team
6	Spaghetti Noodles	200 grams (or one decent scoop)	Up to the team; As we have no weighing scale to verify 200g, the definition of a “decent scoop” means there should be more than just a few strands of pasta. Intuitively, we should be able to see that there is enough pasta on the plate.
7	Cookies	3 pcs	Up to the team; the food must remain intact (in shape or constitution) after placing
8	Fried Eggs	2 pcs	Up to the team; the food must remain intact (in shape or constitution) after placing
9	Surprise Food Item 1	Surprise	Up to the team; the food must remain intact (in shape or constitution) after placing
11	Orange Juice	1/2 to 1/3 cup (up to the waterline)	The robot must pick up the carafe and pour the orange juice into a cup on the tray before returning it to its original location.



SCORING: MANIPULATION

The score for the manipulation challenge is based on the number of food items correctly placed into the target container (tray/plate/cup). Partial points will be given for incomplete food items for multiple item picks. Penalties will be given for damaging food items. Bonus points can be earned for completing a tray and for completing the task below the target time.

TYPE OF POINT	BASIS	POINTS
Gain	Correctly placing food items into the correct target container	+3 points per solid item +15 for Orange Juice (above waterline) OR +5 (substantial but below waterline) <i>e.g., a 5-item food means max score for picking all of it is 15 points. Successful pick & place of only 2 items garners only 6 points.</i>
Bonus	Complete picking of the required quantity of the food items without damaging any of it	+5 points
	Completing one tray within 10 minutes	+20 points
	Completing 2 trays within 20 minutes	+40 points
	Completing 2 trays within 15 minutes	+50 points
Penalties (no gains nor bonus assigned)	Substantial damage to a food item during picking or placing	-3 point per item
	Placing the item into the wrong target container/plate/bowl/cup	-1.5 point per item
	Dropping any food item outside of the source or target container/plate/bowl/cup	-2 point per solid item
	(Items dropped but picked up and placed properly by the robot before the end of the run will not earn penalty point)	-5 for spilling Orange Juice anywhere on the Assembly Table
	Exceeding the quantity or volume of items picked/poured	-1 point per solid item exceeding the limit -5 for Orange Juice overflowing from the cup

It is possible to have a negative score; the highest score possible has potentially no limit. A tray is considered complete if the **correct quantity** and **correct type of food items** are placed in the **correct containers/plates without any substantial damage** to any of the food items.

SURPRISE ITEM

- The surprise item is Ice Gems. You need to **pick 7 pieces** of this.
- The surprise item will replace one of the solid items 30 minutes before your actual run.
 - You will pick a random number between 0 and 5. We will use Google Number Generator. The number chosen will be replaced by the Surprise Item. See diagram above for the number assignment of each item which are replaceable. 0 means there will be no substitution.

ASSEMBLING MORE THAN 2 TRAYS

- You can assemble more than 2 trays with the following conditions:
- The first 2 trays have been assembled such that all items are complete (quantity and type) and are properly placed in their right containers/plates. Moreover, there should be time left.
- In assembling more than 2 trays, teams are allowed to restart their program. During this transition or change, the clock will not be stopped (ie, running time). However, the score will not be reset to zero, instead, whatever is assembled beyond 2 trays will be added to the final score.

INTERRUPTIONS DURING RUN

- **This task will be on a running time.** That is, you can restart the system anytime but the clock will not be stopped.
- Moreover, **every time the system is restarted, the score is also reset to zero.**

ACCIDENTAL MOVEMENT OF ANYTHING IN THE SET-UP

- Will **not** get any penalty, However, deliberate attempt to move anything in the set-up that is not meant to be moved (especially the tables, the shelf, the trays, and the source containers) will be given a **-100 pts** penalty immediately but will be allowed to continue.