ENGINEER 1P13:
PROJECT THREE WORKSHEETS (TEAM)

Table of Contents

PROJECT THREE: MILESTONE ZERO (TEAM): TEAM DEVELOPMENT AND PROJECT PLANNING 3
Milestone 0 – Cover Page 3
Milestone 0 – Team Charter 4
Milestone 0 – Preliminary Gantt Chart (Team Manager Only) 6
PROJECT THREE: MILESTONE ONE (TEAM): PROBLEM FRAMING AND CONCEPTUAL DESIGN 7
Milestone 1 – Cover Page 7
Milestone 1 (Stage 1) – Initial Problem Statement, Objectives and Constraints 8
Milestone 1 (Stage 2) – Refined Problem Statement 11
PROJECT THREE: MILESTONE TWO (TEAM): PRELIMINARY DESIGN 12
Milestone 2 – Cover Page 12
Milestone 2 (Stage 1) – Sensor Selection and Computer Program Workflow (Computation Sub-Team) 13
Milestone 2 (Stage 2) – Detailed Sketches of Mechanism Assembly (Modelling Sub-Team) 17
Milestone 2 (Stage 5) – Informal TA check-in (Modelling Sub-Team) 26
Milestone 2 (Stage 5) – Informal TA check-in (Computing Sub-Team) 28
PROJECT THREE: MILESTONE THREE (TEAM): WORK PERIOD / INFORMAL TA CHECK-IN 30
Milestone 3 – Cover Page 30
Milestone 3 (Stage 3) – Informal TA check-in (Modelling Sub-Team) 31
Milestone 3 (Stage 3) – Informal TA check-in (Computing Sub-Team) 33
PROJECT THREE: MILESTONE FOUR (TEAM): WORK PERIOD / INFORMAL TA CHECK-IN 34
Milestone 4 – Cover Page 34
Milestone 4 – Informal TA check-in (Modelling Sub-Team) 35
Milestone 4 – Informal TA check-in (Computing Sub-Team) 36

PROJECT THREE: MILESTONE ZERO (TEAM): TEAM DEVELOPMENT AND PROJECT PLANNING

Milestone 0 – Cover Page

Team ID: Fri-37

Please list full names and MacID's of all *present* Team Members

Full Name:	MacID:
Milana Kalinic	kalinicm
Maahi Sharma	sharm20
Ben Malkovich	malkovib
Shadi El-Fares	elfaress
Dillon Robert	roberd50

Insert your Team Portrait in the dialog box below

Milestone 0 – Team Charter

Team ID: Fri-37

Incoming Personnel Administrative Portfolio:

Prior to identifying Leads, identify each team members incoming experience with various **Project Leads**

	Team Member Name:	Project Leads
1.	Maahi Sharma	☒M ☒A ☐C ☐S
2.	Ben Malkovich	☐M ☐A ☒C ☒S
3.	Milana Kalinic	☐M ☒A ☐C ☒S
4.	Dillon Robert	☐M ☒A ☒C ☐S
5.	Shadi El-Fares	☒M ☐A ☒C ☐S

To 'check' each box in the Project Leads column, you must have this document open in the Microsoft Word Desktop App (not the browser and not MS Teams)

Project Leads:

Identify team member details (Name and MACID) in the space below.

Role:	Team Member Name:	MacID
Manager	Dillon Robert	roberd50
Administrator 1 (Computing)	Ben Malkovich	malkovib
Administrator 2 (Modelling)	Maahi Sharma	sharm20
Coordinator (Computing)	Shadi El-Fares	elfaress

Coordinator (Modelling)	Milana Kalinic	kalinicm

Milestone 0 – Preliminary Gantt Chart (Team Manager Only)

Team ID: Fri-37

Full Name of Team Manager:	MacID:
Dillon Robert	roberd50

Preliminary Gantt chart

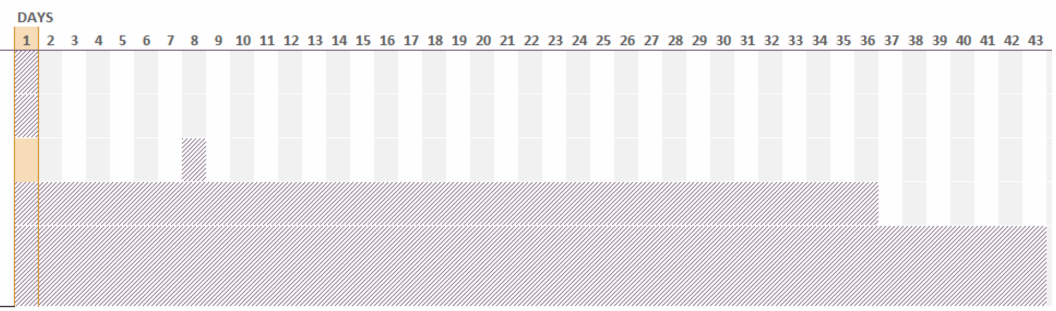
Project 3

Select a period to highlight at right. A legend describing the charting follows.

Period Highlight: 1

Plan Duration · Actual Start · % Complete · Actual (beyond plan) · % Complete (beyond plan)

ACTIVITY	PLAN START	PLAN DURATION	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Milestone 0	1	1			0%
Milestone 1	1	1			0%
Milestone 2	8	1			0%
Detail Design	1	36			0%
Project Demonstration and Interview	1	43			0%



PROJECT THREE: MILESTONE ONE (TEAM): PROBLEM FRAMING AND CONCEPTUAL DESIGN

Milestone 1 – Cover Page

Team ID: Fri-37

Please list full names and MacID's of all *present* Team Members

Full Name:	MacID:
Milana Kalinic	kalinicm
Maahi Sharma	sharm20
Ben Malkovich	malkovib
Dillon Robert	roberd50
Shadi El-Fares	elfaress

Milestone 1 (Stage 1) – Initial Problem Statement, Objectives and Constraints

Team ID:	Fri-37

You should have already completed these tasks individually *prior* to Design Studio 13.

Initial Problem Statements

Copy and paste the initial problem statement(s) below.

Design a system for sorting and recycling containers.

Objectives and Constraints

Copy and paste each team member's Objectives and Constraints tables here or combine the objectives and constraints into the single table below.

Objectives	Identify different materials via sensors. Assess recyclability of items. Transfer items to a transport system. Facilitate the transport of items to their designated bin. Dispense items into their designated bin. Deposit mechanism should mount easily to frame. Return transport system to the original position to receive more items. Code is easy and intuitive to use by user Code accurately identifies container and sorts it Containers are securely transferred

	Mechanism angle chosen such that container is precisely deposited into correct bin Program efficiently and quickly identifies container type and deposit bin Determing Container Variables o Mass dependant delivery later. Sensor Activation and Deactiviation – Trajectory Following – Home Position Return – Repeated Task Execution (i.e the above in a loop of some kind) Virtually mounted sensors Maintenance and Reliability (if we consider a long-term solution) Cost Consideration (More of Modelling as I believe they have to pay)
Constraints	Program needs to be able spawn exactly six containers (iterate through a list of six container ID's) Q-bot must follow a line on the floor to move to different locations (cannot make shortcuts i.e. cut through the middle) Each container ID must be assigned specific attributes and specific target bins (cannot randomly assign attributes) Can only transport one item type at a time. Total item load cannot exceed 90 grams. Only can transport 3 containers maximum. Only 4 possible bin designations. Deposit mechanism can only use linear or rotary actuator. Mechanism must function with given hopper and base plate. Code is written in Python

	Workflow/steps outlined in Project Module are followed (Qbot transfers container, deposits it, returns to home, etc.) Different types of containers are deposited to their respective bins (determined by material, contamination, etc.) Actuator must mount within a specific region of designated mechanism that connects to baseplate and connecting plate Mechanism must connect to base plate and connecting plate User Input Validation (code is not completely autonomous) Bin Recognition Accuracy Safety Measures Power Consumption Environment Adaptability (having the Q-bot understand the environment it will work in) Sensor accuracy

We are asking that you submit your work on both worksheets. It does seem redundant, but there are valid reasons for this:

- Each team member needs to submit their work with the **Milestone 1 Individual Worksheet** document so that it can be ***graded***
- Compiling your individual work into this **Milestone 1 Team Worksheet** document allows you to readily access your team member's work
    - This will be especially helpful when completing ***Stage 2*** of the milestone

Milestone 1 (Stage 2) – Refined Problem Statement

Team ID: Fri-37

Refined Problem Statement

1. As a team, write the refined problem statement below. Kindly refer to the Refined Problem Statement rubric in the P3 Project Module. This will guide your group in creating a valid statement.

Design a sorting system that can accurately sort recyclable items from those that aren't, since the current system is unable to accommodate for a complete sorting solution, and is therefore highly inefficient.

PROJECT THREE: MILESTONE TWO (TEAM): PRELIMINARY DESIGN

Milestone 2 – Cover Page

Team ID: Fri-37

Please list full names and MacID's of all *present* Team Members

Full Name:	MacID:
Shadi El-Fares	elfaress
Milana Kalinic	kalinicm
Maahi Sharma	sharm20
Ben Malkovich	malkovib
Dillon Robert	roberd50

Milestone 2 (Stage 1) – Sensor Selection and Computer Program Workflow (Computation Sub-Team)

Team ID: Fri-37

1. As a sub-team, discuss the results of your individual sensor demo activity and select the sensor(s) that you will use in your project. Identify the sensor(s) in the box below and include any decision-making tools or justification in the space provided. *Teams are allowed to use a maximum of 2 sensors*

Chosen Sensors: Color Sensor, Ultrasonic Sensor

Decision-making tools and/or justification: The color sensor will facilitate easy differentiation of containers based on color, eliminating the need to distinguish between metal, paper, or plastic. This choice is supported by the observation that the demo bot effectively follows the yellow color. The ultrasonic sensor is chosen for its larger range and convenient return values, making it easier to work with compared to IR and Hall sensors. Additionally, the IR and Hall Sensors have limitations in range which would require additional functionalities for the same served purpose. The decision is grounded in the practical advantages of these sensors for the project's objectives.

2. As a sub-team, write out the pseudocode or create a flowchart for the indicated tasks in the space below
   → If creating a flowchart, complete your flowchart on a separate sheet of paper, take a photo of your sketch and insert photo as a Picture under the appropriate task

Dispense Container

- Rotate platform until container detected
- Use above to determine bin location for container

Load Container

```
Initialize a list giving the coordinates of the pickup position
Initialize a list of lists containing the positions for each drop off
Initialize the count of containers as 0
Initialize a variable describing matching IDs as true
Store the bin ID of the current container
Store the mass of the current container
Set while loop that runs when there are less than 3 containers, the mass is less than 90 grams,
and the ID match variable is true
        Move arm to the coordinates given, close claw
        Move arm to Qbot hopper using coordinates in the drop off list, release claw
        Move to home position
        Iterate the count by 1
        Get the bin ID of the next container
        If the new container has the same bin ID
                Add the new mass to the mass of the first container
        If the ids do not match (else)
                Set the ID match variable as False
```

Transfer Container

Initialize a target bin ID as the bin id the qbot must move to

Initialize a list of lists containing RBG values of each bin, 1 – 4

Set the target list of values as the corresponding list in the list of lists

Set arrived variable as False

Activate the colour sensor

Activate the qbot so it begins moving along the path

Set up a while loop so while arrived is False these actions are taken

    Obtain the RGB values output by the colour sensor (first list)

    If what the sensor reads matches the targeted bin

        Stop the qbot

        Set arrived as True

Deposit Container

1. Q-bot identifies and positions the containers into the appropriate destination bins.
2. Q-bot needs to be shifted until the hopper is next to the bin.
3. The hopper undergoes rotation to deposit containers into the bin.
4. Q-bot is realigned with the trajectory line after positioning.

Return Home

- Return hopper to initial position
- Activate colour sensor
- Move Q-bot along path using colour sensor
- Set up a loop to stop the Q-bot once its returned home
- Rotate Q-bot back into original orientation

Milestone 2 (Stage 2) – Detailed Sketches of Mechanism Assembly (Modelling Sub-Team)

Team ID: Fri-37

1. As a sub-team, review your concept mechanism concept sketches, and use a decision-making tool of your choice to decide which mechanism design to pursue. Examples of decision-making tools include simple or weighted decision matrices (Slide 22 of the P1 Milestone 3A Slides). Show evidence of your decision-making below, and clearly identify which mechanism design your sub-team has chosen.

Name: Milana Kalinic	MacID: kalinicm
Name: Maahi Sharma	MacID: sharm20
Show your decision-making process below, and clearly identify which mechanism concept your team will pursue. ***Chosen Design:*** *Triangular Linkage Mechanism* ***Design Process:*** **Below are pictures of how we went through our design process for the mechanism.**	

Design Process:

? Things to consider!!

- strength of mechanism
- is laser cutting ideal?
- linear or rotary?
- which actuator offers more accuracy?
- Do we need to consider shapes and forces?

Some Background Knowledge!

Fact!

↳ triangular shapes are known to be the strongest shapes in construction; any load at the top of a triangle splits itself into two loads, offering more stability

* consider this when developing the structure and shape of the mechanism.

Fact!

↳ to output most movement with minimal force required, torque should be applied a farther distance away from pivot point!

* consider this when determining where to hook mechanism onto hopper.

Pros and Cons: Linear vs Rotary Actuator

Linear Actuator

Pros

- ✓ offers more control over movement
- ✓ linear movement is more guaranteed
- ✓ gears may be excluded from mechanism if desired!

Cons

- ✗ could offer difficulty when lifting hopper at an angle
- ✗ limited movement options, only linear movement

Rotary Actuator

Pros

- ✓ offers more choices of movement
- ✓ high force output
- ✓ gears may be included in mechanism if desired!

Cons

- ✗ movement may not be so accurate, interruptions
- ✗ laser cutting gears for actuator may result in errors (need a lot of precision)

Better Choice?

Justification of Design:

Our chosen design incorporates the use of a linear actuator to drive the mechanism. For the mechanism, two support bars are strategically arranged onto the base plate in the shape of a triangle, with a small height when in transfer position (refer to detailed sketch of transfer position below). One of the support bars will be attached to the linear actuator with the use of a sliding plate (grounded to the base plate). The linear actuator will then move the support bar, causing it to push the support bar on the opposite side. The linkage between both bars will then **lift** the hopper. Additionally, to ensure that the support bars are effectively able to lift the hopper, a degree of freedom must be incorporated between the linkage of the support bars and the hopper. This can be done by including a notch between the linkage and hopper, which can rotate depending on the angle that the hopper is lifted at (refer to detailed sketch of deposit position below). After dropping off the containers, the linear actuator will move the mechanism back to its transfer position until the next round of dropping off containers.

The triangular configuration of the mechanism is a key element to our design, as it implements its inherent structural robustness, and minimizes the chances of error/failure. Our design also considers the point of contact between the linkage and hopper, and what position would offer the most force. This is an important aspect of the design, since pushing the hopper a further distance away from its hinge would be more optimal than pushing it closer to its hinge (reflect on torque). To achieve this design component, our support bars would vary in length, meaning that one would have to be longer than the other to provide the optimal point of contact.

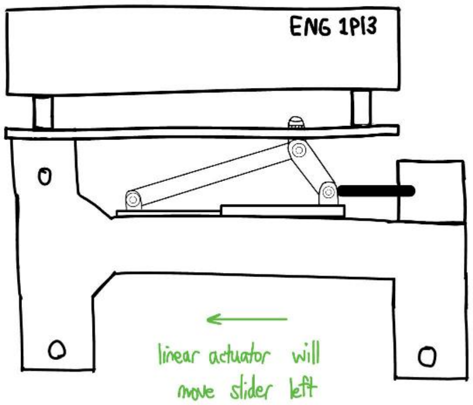
Team ID: Fri-37

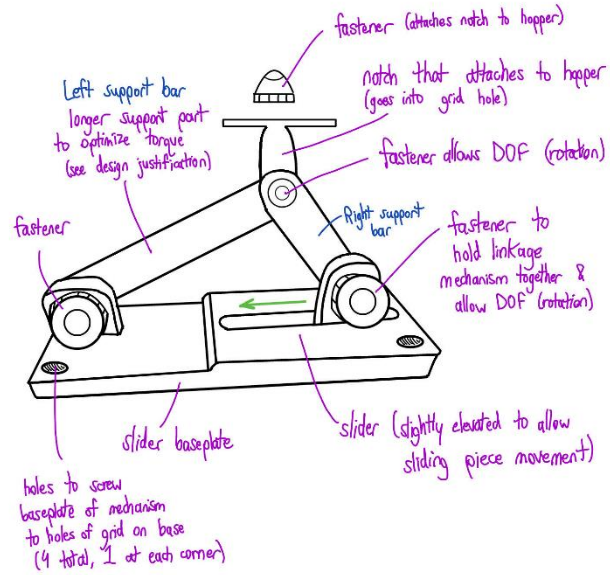
2. As a sub-team, select a design for your mechanism, then use that one (1) design for the detailed sketches.
   → Each sub-team member is responsible for one (1) detailed sketch of the same design, either in the transfer position or the deposit position
   → For sub-teams with 3 members, the work of 2 sketches should be split evenly between members. For example, 2 members could complete the sketches while the other member adds labels, descriptors, and constraints to both sketches.
   → Complete your sketches on a separate sheet of paper
      i. Be sure to indicate each team member's Name and MacID
   → Take a photo of your sketch
   → Insert your photo as a Picture in the space below

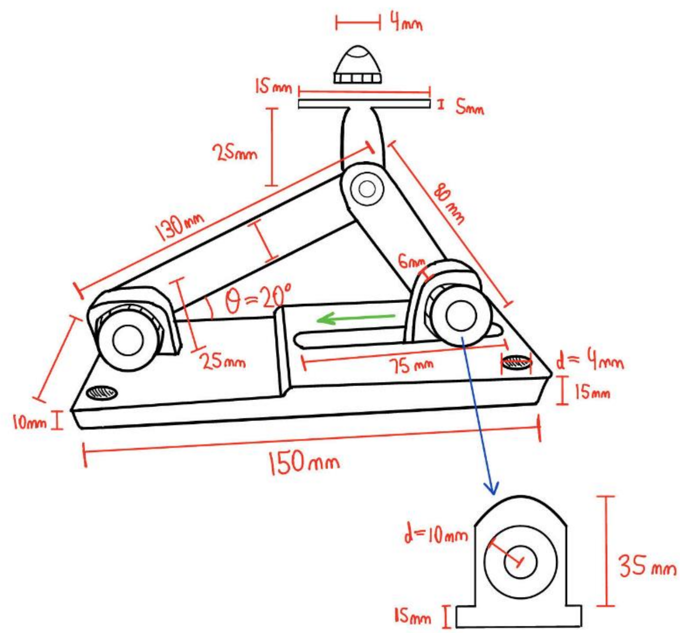
Team ID: Fri-37

Name: Milana Kalinic	MacID: kalinicm

Transfer position







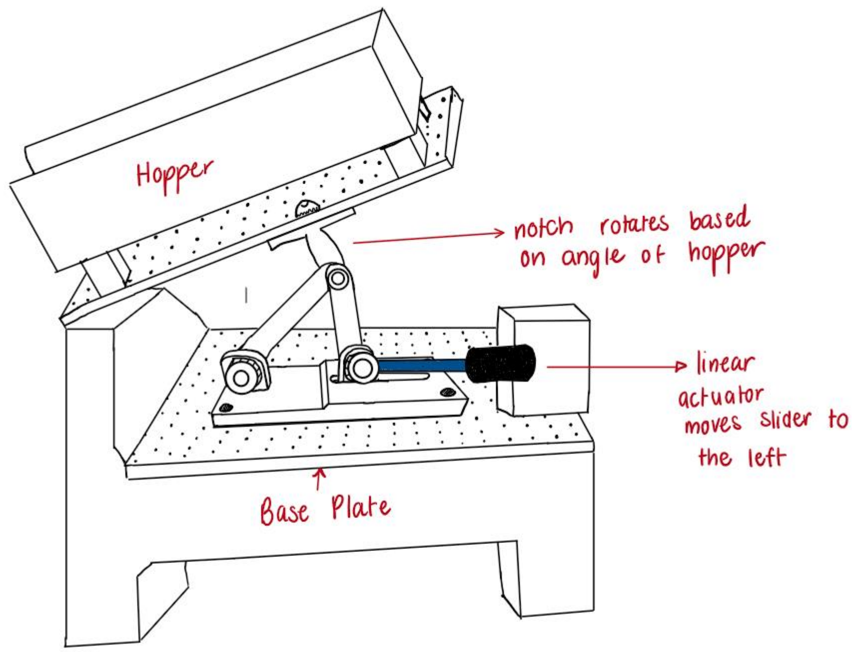
Constraints in transfer position:

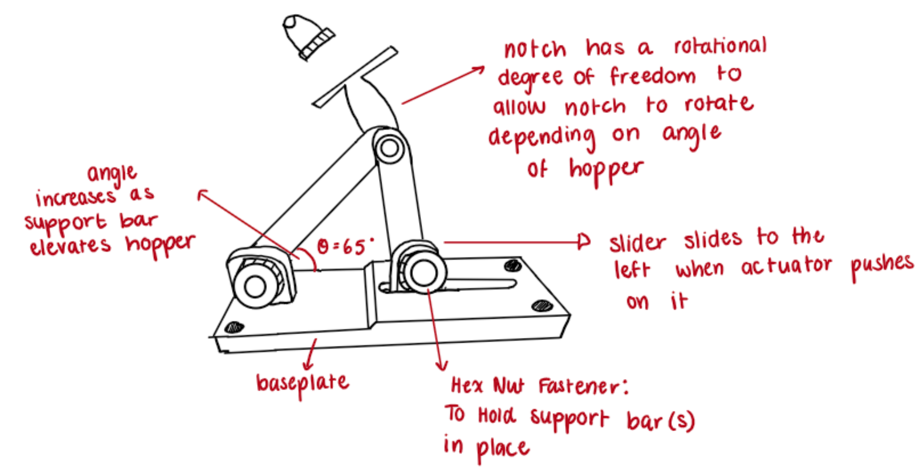
- Notch
  - Notch must have ONE rotational degree of freedom to allow for notch to rotate along with the hopper when the cans are being deposited
- Slider Baseplate:
  - Slider baseplate of mechanism must be grounded to the baseplate of the hopper assembly
- Support Bars:
  - Each support bar must have ONE rotational degree of freedom to allow for rotation
- Slider
  - Must have ONE horizontal translational degree of freedom, to allow the linear actuator to move it

Team ID: Fri-37

Name: Maahi Sharma	MacID: sharm20

*Insert picture of the **deposit** detailed sketch below*





Constraints in Deposit Position:

- Angle of Rotation:
    - Angle of left support bar must be larger than when in transfer position, to allow for hopper to lift at an angle
- All holes on slider baseplate MUST have a diameter of 4 mm to match the holes on the baseplate

Milestone 2 (Stage 5) – Informal TA check-in (Modelling Sub-Team)

Team ID: Fri-37

☐ Sketches include ONE actuator (linear or rotary) that is the input of the mechanism

☐ Sketches in both deposit and transfer position are drawn.

- Components are identified and labelled
- Any relationships and constraints (such as assembly constraints and motion constraints) are highlighted.
- Component that will serve as the grounded part of the assembly once conducted is identified.

Output of the mechanism allows for rotation of the connecting plate/hopper. Rotation angle is sufficient to allow for container deposit.

☐ The mechanism attaches to both the baseplate and the connecting plate (below the hopper)

☐ Mass of all components is considered

- The design should intentionally minimize materials

Mentor Comments: Use the space below to document mentor feedback for your design, including requirement for reviewing progress next design studio.

- Overall good design process and justification of design
- Consider how much the linear actuator can extend (about 5 cm)
- Are parts dimensioned with the consideration that the linear actuator can let the mechanism lift the hopper enough?
- REMEMBER: linear actuator is not raised! It is placed flat onto the baseplate
- Can we get enough force outputted onto the mechanism to lift the hopper with our current design?
- Adjust desired angle of hopper when in deposit position (might be too large)

Action Items: Use the space below to propose design refinements based on feedback.

- Redesign baseplate so that the slider slides along the base of the hopper
- Adjust dimensions of parts with greater consideration of the placement of the linear actuator
- Adjust hole placements to fit the grid of the base
- Reconsider lengths of linkages (ensure that linkages can lift the hopper to an adequate angle)

Milestone 2 (Stage 5) – Informal TA check-in (Computing Sub-Team)

Team ID: Fri-37

☒ A sensor(s) has been selected. Discuss reasons as to why the group chose said sensor(s).

☒ The following tasks have been planned either in pseudocode or flowchart format:

- → Dispense container
- → Load container
- → Transfer container
- → Deposit container
- → Return home

☒ The following tasks are planned in pseudocode or flowchart format as their own functions:

- → Load container
- → Transfer container
- → Deposit container

☒ Do the tasks cover the following:

- Container attributes are determined
- Containers are positioned in the sorting station
- Q-arm loads the containers until one of the following conditions are met:
  - A container with a different ID is placed in the sorting station
  - The total mass of the bottle placed in the sorting station and the bottles loaded on the Q-bot is greater than 90 grams
  - 3 bottles have been placed on the Q-Bot
- Q-bot transfers the containers to the correct recycling bin
- Q-bot deposits the containers into the bin
  - If needed, Q-bot turns 90 degrees to face the required bin, and then locomotes to bin
- Q-bot returns home
- Cycle repeats

Mentor Comments: Use the space below to document mentor feedback for your design, including requirement for reviewing progress next design studio.

Don’t include python syntax when submitting pseudocode. The table that dispenses the bottles doesn’t need to be included in our dispense container function. Using IR Sensors to traverse the line not the color sensor

Action Items: Use the space below to propose design refinements based on feedback.

Get rid of current python code in pseudocode Adjust the current angle of the joint, and consider the position of the linear actuator to generate enough force.

PROJECT THREE: MILESTONE THREE (TEAM): WORK PERIOD / INFORMAL TA CHECK-IN

Milestone 3 – Cover Page

Team ID: Fri-37

Please list full names and MacID's of all *present* Team Members

Full Name:	MacID:
Maahi Sharma	sharm20
Milana Kalinic	kalinicm
Ben Malkovich	malkovib
Dillon Robert	roberd50
Shadi El-Fares	elfaress

Milestone 3 (Stage 3) – Informal TA check-in (Modelling Sub-Team)

Team ID: Fri-37

☐ Assembly includes one actuator (linear or rotary) that is the input of the mechanism

☐ Output of the mechanism allows for rotation of the connecting plate/hopper. Rotation angle is sufficient to allow for container deposit.

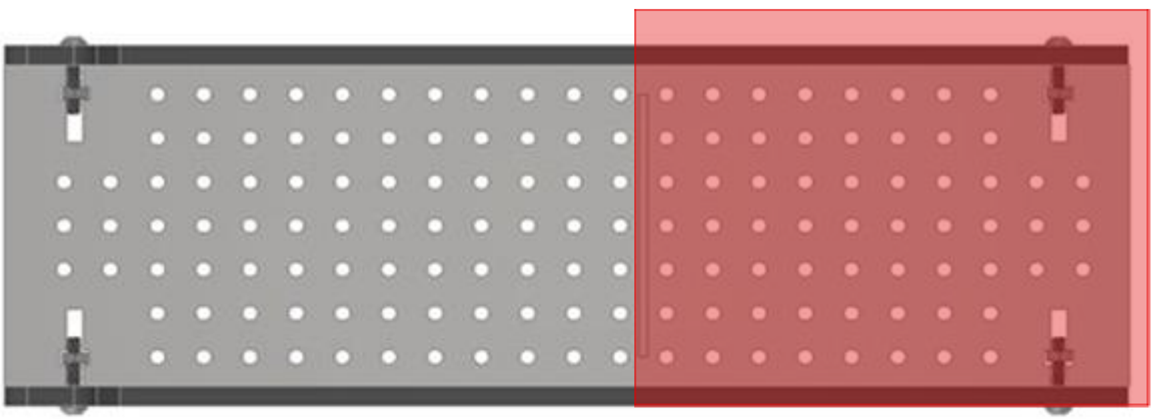
☐ Assembly is complete and constrained properly

→ No interference between parts, clean assembly model, no errors, one part grounded

→ Proper assembly constraints (define position of components in assembly)

→ Proper motion constraints (define motion ratios between assembly components)

☐ The mechanism attaches to both the baseplate and the connecting plate (below the hopper)



☐ All *holes* on the chosen actuator housing are *attached* WITHIN the highlighted region (see figure above)

☐ Mass of all components is considered

- The design should intentionally minimize materials

☐ Total print time of ALL 3D printed components does not exceed 2 hours

- Discuss a prototyping plan. Is it within the time constraint to re-print or redesign if needed?
- Discuss if components need any support for 3D printing (i.e., for any overhanging features). If so, TAs will assist the sub-team in adding supports
- Discuss/suggest potential for laser-cutting (flat components in particular)

☐ ALL features of 3D printed parts are feasible for printing

- Features and spaces are suggested to be 2mm or greater (Features between 2mm and 4mm are appropriately sized and will not compromise the printed design)

☐ Consideration of additional materials

- Students have considered and sourced any additional materials as necessary (i.e. fasteners)

Mentor Comments: Use the space below to document mentor feedback for your design, including requirement for reviewing progress next design studio.

- Enable contact set in assembly file
- Redo offset constraint (could be Inventor error)
- The angle the mechanism elevates the hopper to is large enough, but the hopper not being completely horizontal in the transfer position is an issue
- Laser cut support bars to save time
- The friction of the slider might be too high for it to slide back in the baseplate when the linear actuator retreats; attach link to the linear actuator with a bolt/rod so that the slider moves with it
- Add a matching hole in the slider to put the bolt/rod through it to fix it to linear actuator
- Make a cut in the baseplate for the bolt to slide through along with the slider
- ALTERNATIVE MECHANISM METHOD: Attach the link directly to the linear actuator; get rid of the slider and baseplate altogether
- Review design next design studio

Action Items: Use the space below to propose design refinements based on feedback.

- Implement TA's suggested mechanism method
- Shorten baseplate such that it just holds the joint to allow linkage to rotate
- Get rid of slider and attach linkage directly to linear actuator using a bolt
- Change dimensions of linkages to accommodate altered design (elongate right linkage)

Milestone 3 (Stage 3) – Informal TA check-in (Computing Sub-Team)

Team ID:	Fri - 37

☐ All 5 program tasks are accounted for (dispense container, load container, transfer container, deposit container, return home)

☐ One cycle (for ONE container of the sub-team's choice) sufficiently executes based on requirements outlined in project module

- The general flow: home → dispense → load → transfer → deposit → home

☐ The following tasks are written as their own functions:

- Load container
- Transfer container
- Deposit container

☐ The return home task executes properly by following the yellow line *around the loop* and back to the sorting station

☐ No errors in program

☐ Commenting their code (i.e., headers explaining purpose of functions & any other appropriate comments where needed)

Mentor Comments: Use the space below to document mentor feedback for your design, including requirement for reviewing progress next design studio.

Fix the transfer container function, having an issue down to bot wheel speed or potentially the distance to the bins Add sleeps into load container so it can run properly Bot is wobbly on the line, fix bot wheel speeds Main function should repeat instead of running once Containers should be loaded in different positions instead of just one

Action Items: Use the space below to propose design refinements based on feedback.

Edit the main function to run multiple times Fix wheel speeds and transfer container function so it properly dispenses containers every time Fix the load container function so it places containers properly

PROJECT THREE: MILESTONE FOUR (TEAM): WORK PERIOD / INFORMAL TA CHECK-IN

Milestone 4 – Cover Page

Team ID: Fri-37

Please list full names and MacID's of all *present* Team Members

Full Name:	MacID:
Maahi Sharma	sharm20
Milana Kalinic	kalinicm
Shadi El-Fares	elfaress
Ben Malkovich	malkovib
Dillon Robert	roberd50

Milestone 4 – Informal TA check-in (Modelling Sub-Team)

Team ID: Fri-37

☐ Design Meets Design Objectives

→ Facilitates container depositing (visual inspection that the hopper rotates enough for container depositing)

☐ Physical model is complete and works as intended

→ All components are ready for assembly or assembled

☐ Mass of all components is considered

→ The design should intentionally minimize materials

☐ ALL features are reasonably sized

→ No components contain small features that are likely to break

☐ Consideration of additional materials

→ Students have considered and/or sourced additional materials as necessary (ie. fasteners)

☐ APPROVED FOR PHYSICAL ENVIRONMENT

Mentor Comments: Use the space below to document mentor feedback for your design, including requirement for reviewing progress next design studio.

- Lower stand-piece to make hopper rest horizontally (if it doesn't)
- No rotational degrees of freedom in mechanism assembly on Inventor
- May have made too many links; removed too many DOF
- Fix: delete constraint on the holes that fit the plate of the mechanism to the top of the hopper, but leave mate constraint

Action Items: Use the space below to propose design refinements based on feedback.

- Remove constraint on the holes that fit the plate of the mechanism to the top of the hopper so that the plate can slide and introduce a degree of freedom to lift the hopper
- Lower stand-piece to make hopper rest horizontally

Milestone 4 – Informal TA check-in (Computing Sub-Team)

Team ID: Fri-37

☐ More than one cycle of pick-up/transfer/drop-off sufficiently executes

→ At least two different containers are correctly deposited

→ The general flow should be Home → Dispense Container → Q-Arm Loads Container onto Q-Bot → Transfer Container to Proper Bin → Deposit Container → Home

→ Q-Bot should determine bin using line-following and using measured sensor values.

→ If the bins are setup so that they are far away from the yellow loop, the Q-Bot should move as specified on page 16 and 17 of the project module.

☐ All required program tasks are written as their own section of code (Dispense Container, Return Home) or function (Load Containers, Transfer Containers, Deposit Containers)

☐ No errors in program

☐ Code well commented

☐ APPROVED FOR PHYSICAL ENVIRONMENT

Mentor Comments: Use the space below to document mentor feedback for your design, including requirement for reviewing progress next design studio.

Ensure that the hopper lid rotates down (didn't for some reason).

Update main function so it has a while loop, runs indefinitely.

Show the start of a successful run.

Almost ready for physical environment aside from comments above

Action Items: Use the space below to propose design refinements based on feedback.

Add in appropriate deactivate/activate functions to lower hopper.

Add while loop in main() function.

Further refine code.