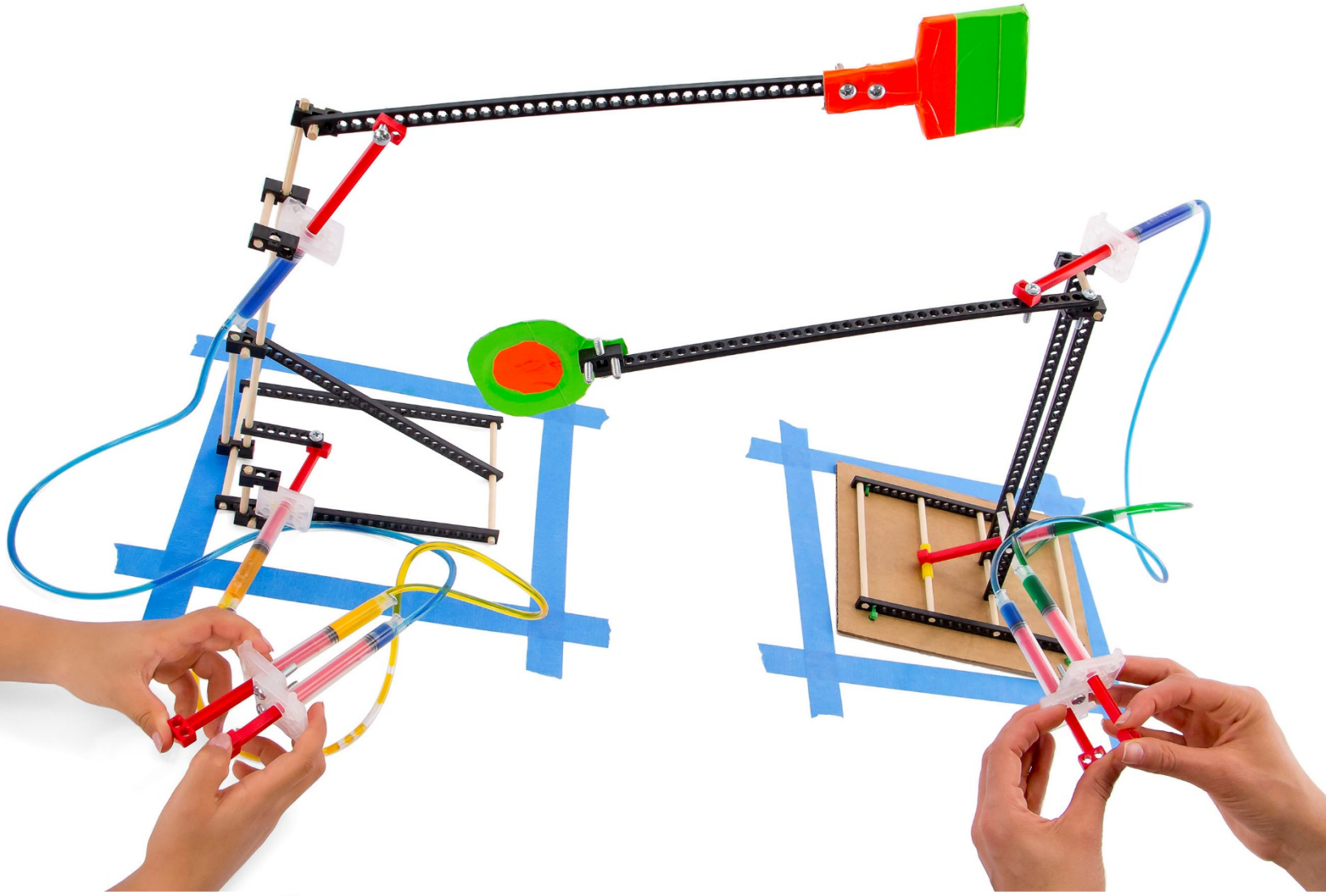
BUILD GUIDE FOR JUDO-BOTS

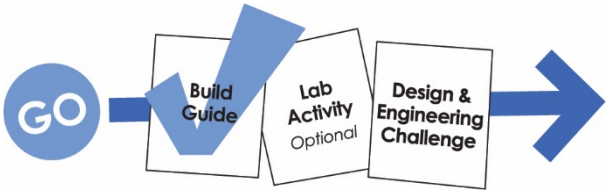
TeacherGeek



STEM TRUE STEAM

Download classroom documents at **teachergeek.com/learn**

For use with TeacherGeek Judo-Bot Activity Pack,
or Maker Cart available at **teachergeek.com**.



BUILD GUIDE FOR JUDO-BOTS

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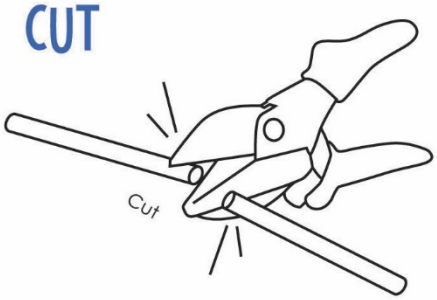
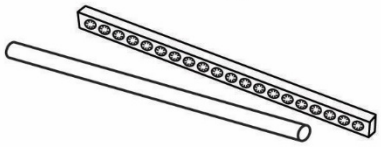
CUT

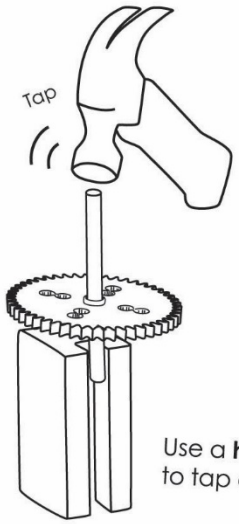


Multi-Cutters cut wood & plastic (like **dowels** and **connector strips**). They do not cut metal.



PUSH, WIGGLE, TAP

Push, wiggle or tap **dowels** into holes.



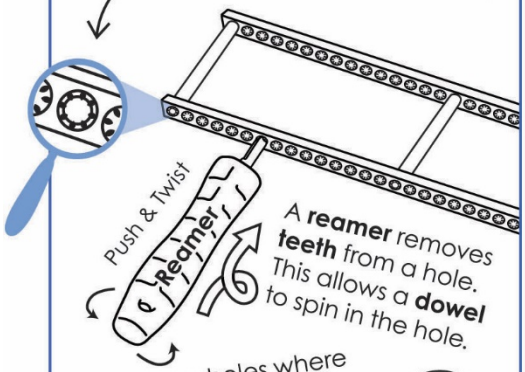
Use a **hammer** and **slider block** to tap **dowels** farther through holes.

QUICK TIP!

Use a crayon or soap on the end of a Dowel to make building easier.

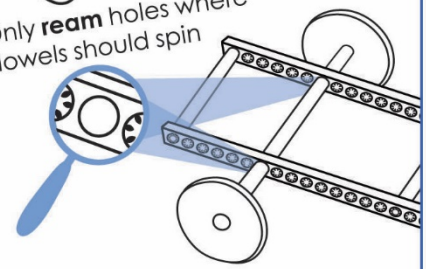
REAM

Most parts have holes with **teeth**. The **teeth** hold **dowels** (keep dowels from falling out).



A **reamer** removes **teeth** from a hole. This allows a **dowel** to spin in the hole.

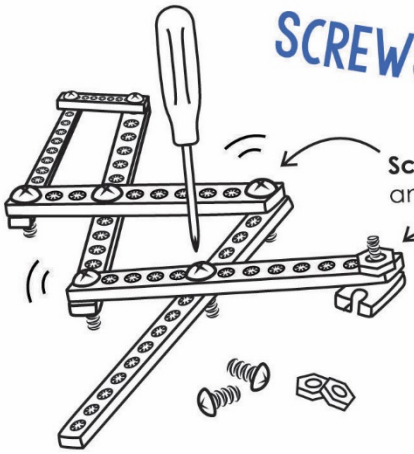
Only **ream** holes where dowels should spin



Never **ream pulleys**, **gears**, **wheels**, or any hole a **dowel** stays stuck into.

SCREWS & NUTS

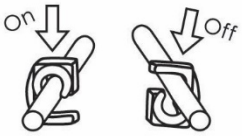
Do not **ream** holes you will put **screws** into.



Screws (without nuts) can connect parts, and allow them to rotate.

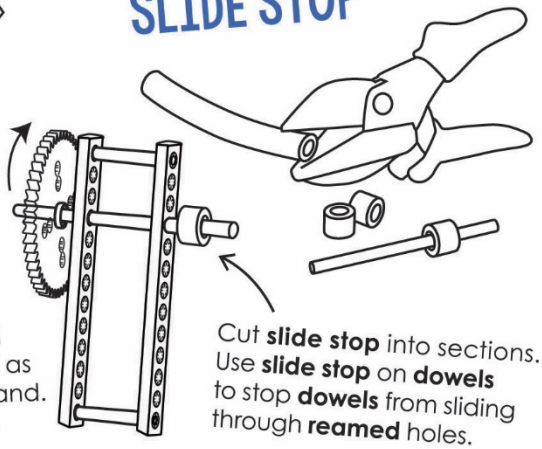
Screws (with a nut) can connect parts, and keep them from rotating.

STOP CLIP



Press a **stop clip** onto a **dowel** to keep it from sliding or use it as a hook for a string / rubber band. It takes little force to get it on.

SLIDE STOP



Cut **slide stop** into sections. Use **slide stop** on **dowels** to stop **dowels** from sliding through **reamed** holes.

BUILD GUIDE FOR JUDO-BOTS

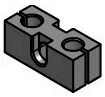
TEACHERGEEK COMPONENTS

Below is the list of "ingredients" you'll need for one Judo-Bot.
Available as single: SKU 1824-72 or 10 pack: SKU 1824-62. Both include extra parts for your own innovative creations!

6 - Connector Strips

6 - Dowels
300mm (12")

1 - Slide Stop
76mm (3")



8 - Blocks

4 - 4.5mL Cylinders

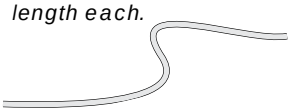
*If using the Maker Cart vinyl tubing **roll**, cut two sections, 2 ft. in length each.*

4 - Cylinder Screws

6 - 25mm Screws
#10 25mm (1")

6 - Nuts
#10

4 - Zip Ties



2 - 2 ft. Vinyl Tubing

TEACHERGEEK TOOLS

This isn't a kit. You're going to really build (cut, ream, screw) your Judo-Bot.
Here are tools you'll need to get started:

- **Reamer**
- **Multi-Cutter**
- **Tapping Block**
- **Hammer**
- **Pliers**
- **Screwdriver**

Or get the complete
TeacherGeek / Maker Tool Set
Single SKU 1823-24
Class Set SKU 1823-85

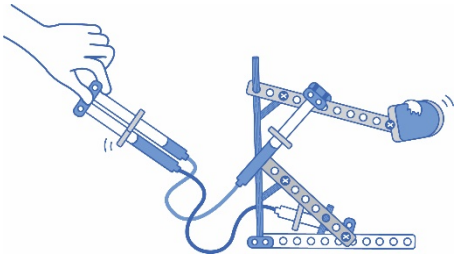
MATERIALS YOU SUPPLY

Tape

Recycling Materials
What else could you use for a Judo-Bot base?

Crayon
Rub on dowels to make sliding them easier into holes of components.

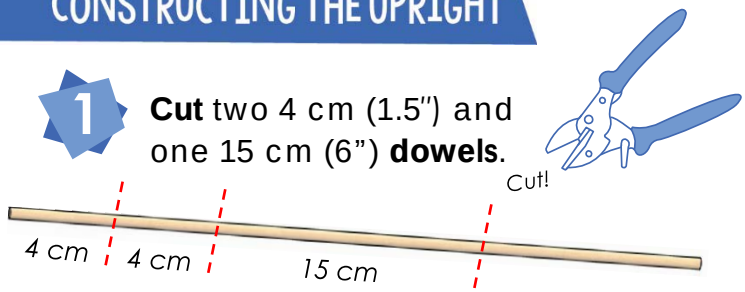
BUILD GUIDE FOR JUDO-BOTS



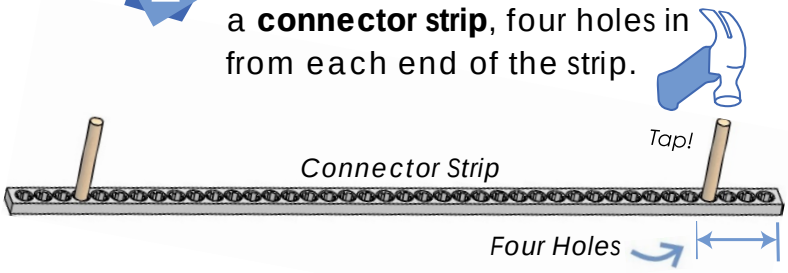
Are you ready to R-U-M-B-L-E?!
In this guide, you will build an example **Judo-Bot**.
Design a bot-for-battle using **levers** and **fluid power**.

CONSTRUCTING THE UPRIGHT

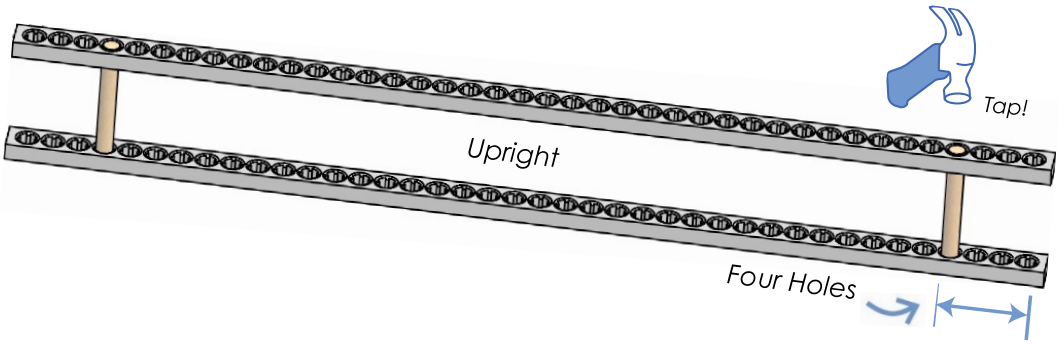
1 **Cut** two 4 cm (1.5″) and one 15 cm (6”) **dowels**.



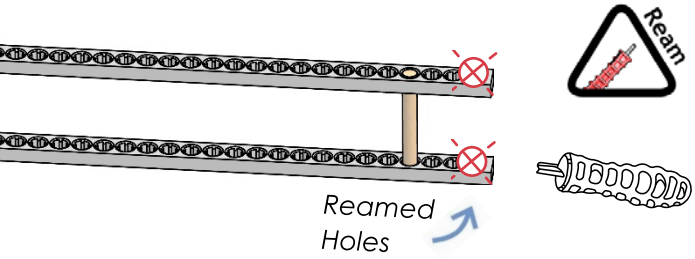
2 **Tap** the **dowels** from **Step 1** into a **connector strip**, four holes in from each end of the strip.



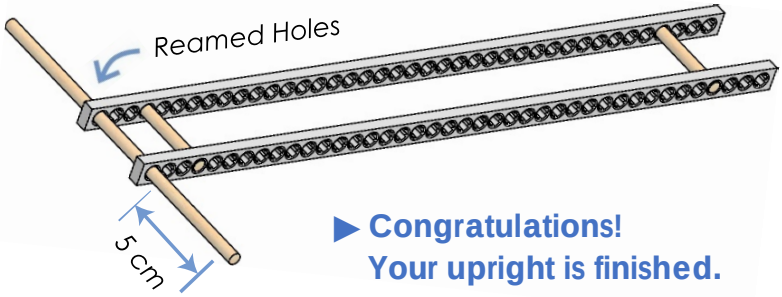
3 **Push** or **tap** a **connector strip** onto the **dowels** from **Step 2**.
This will be your **upright**.



4 **Ream** the top two **holes** at one end of your **upright**.



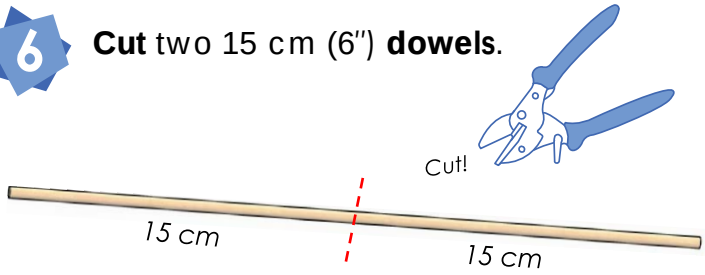
5 **Insert** the 15 cm (6”) **dowel** from **Step 1** into the **reamed** holes from **Step 4**.
Let 5 cm (2”) hang off both sides.



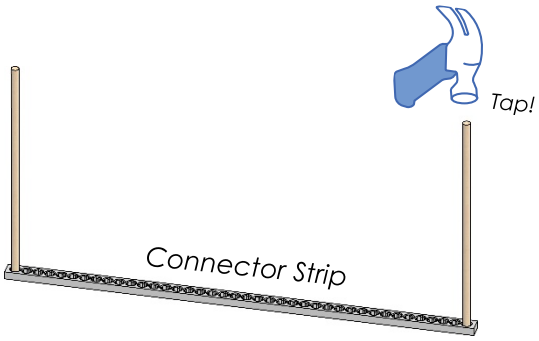
▶ **Congratulations!**
Your upright is finished.

CONSTRUCTING THE BASE

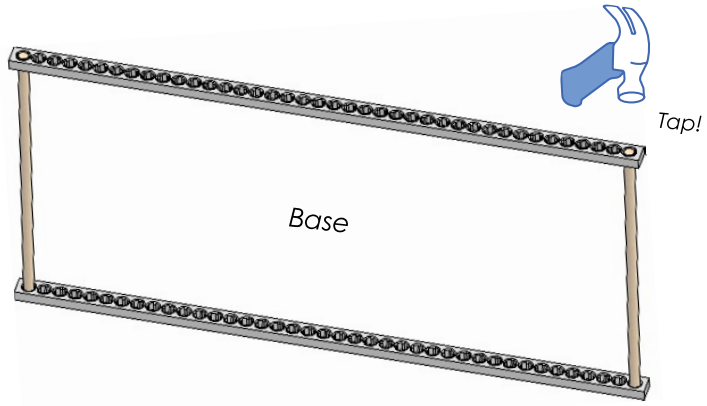
6 **Cut** two 15 cm (6″) **dowels**.



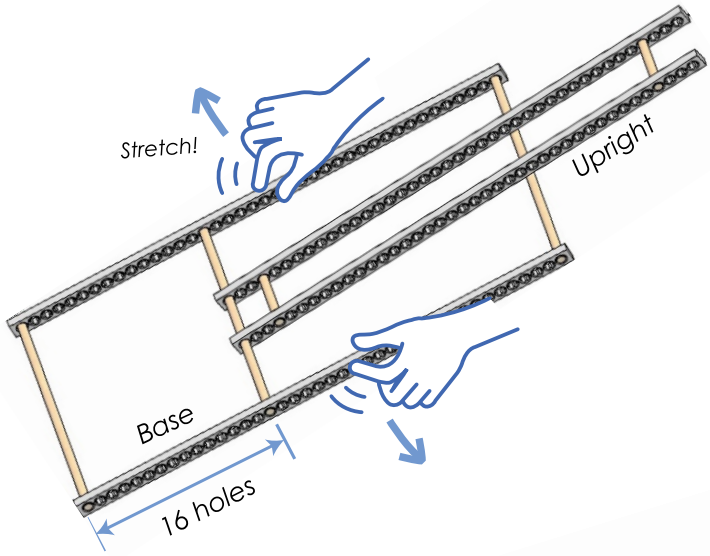
7 **Tap** the **dowels** from **Step 6** into the **first hole** on each end of a **connector strip.**

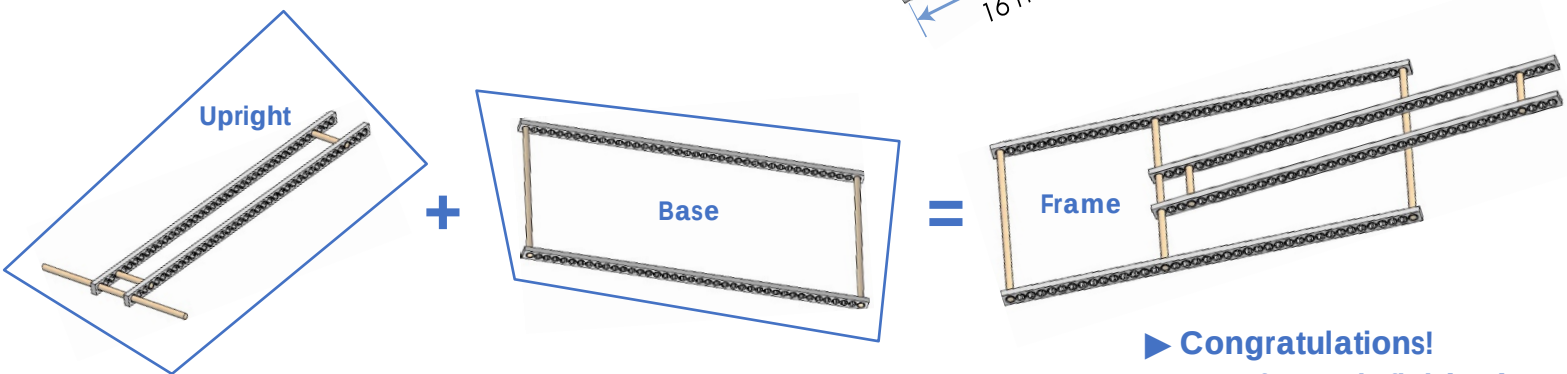


8 **Push** or **tap** a **connector strip** onto the **dowels** from **Step 7**.
This is your Bot's base.



9 **Place** the **upright** from **Step 5** in the **base. Stretch** the base to **align** the **dowel** with the 16th hole of the strips.

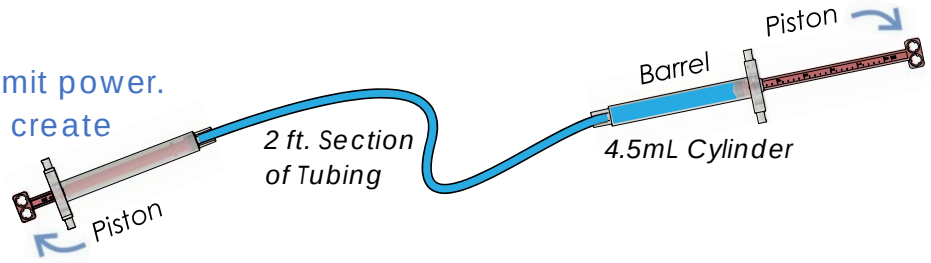




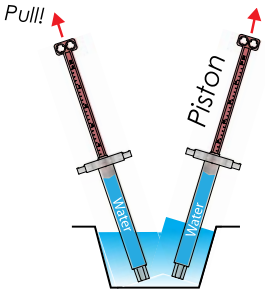
▶ **Congratulations!**
Your frame is finished.

HYDRAULIC SYSTEMS

Hydraulic systems use fluid to transmit power. Using cylinders and tubing, you will create a hydraulic "control" system to move your Judo-Bot.

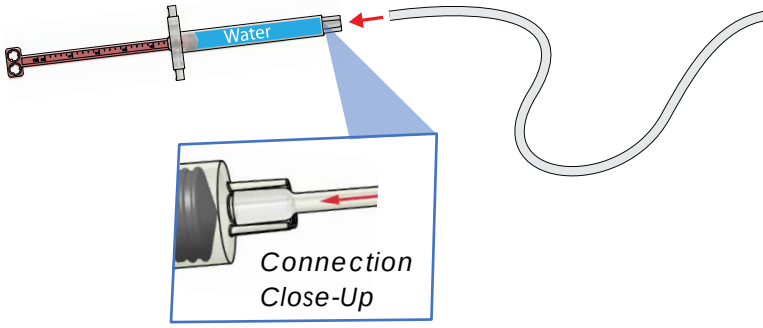


10 **Fill** two 4.5 ml **cylinders** with water. **Submerge** the cylinder **barrel** in water. Pull the **piston** out to fill the barrel completely with fluid.

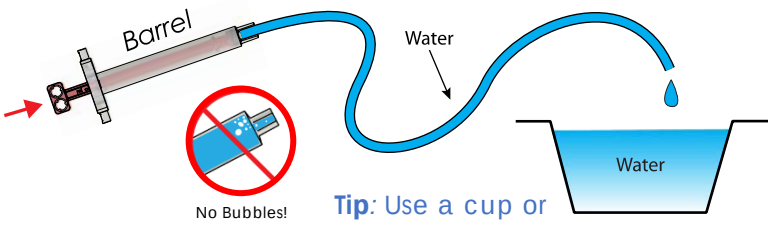


Tip: to work properly, no air bubbles should be in the cylinders or tubes.

11 **Attach** a 2 ft. **tubing** section to one filled **cylinder** from **Step 10**.

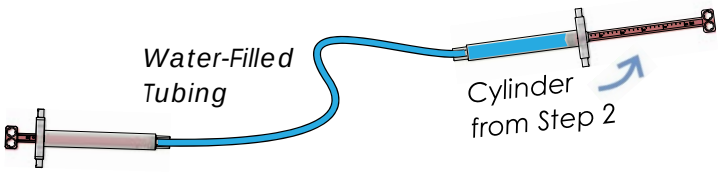


12 **Fill** the **tubing** from **Step 11** with water. **Pull** the **piston** back, then **push** in to fill the tubing with fluid. The **barrel** will be **empty**.

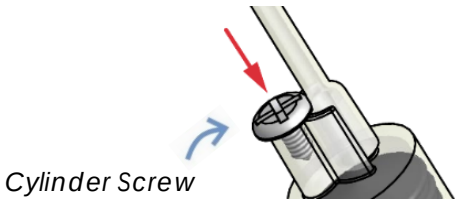


Tip: Use a cup or glass to catch fluid.

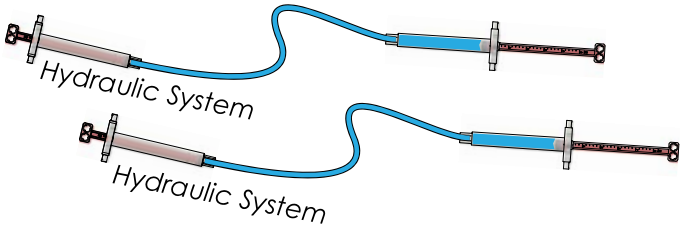
13 **Attach** the water-filled **tubing** from **Step 12** to the second cylinder from **Step 11**.



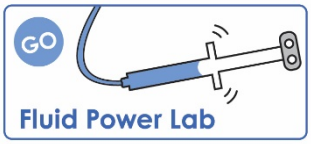
14 Keep the **tubing attached** with a cylinder **screw**. Insert the screw into the **hole** aside each cylinder's **tip**.



15 **Repeat Steps 10-14** to create another **hydraulic system**. These will power your Judo-Bot.



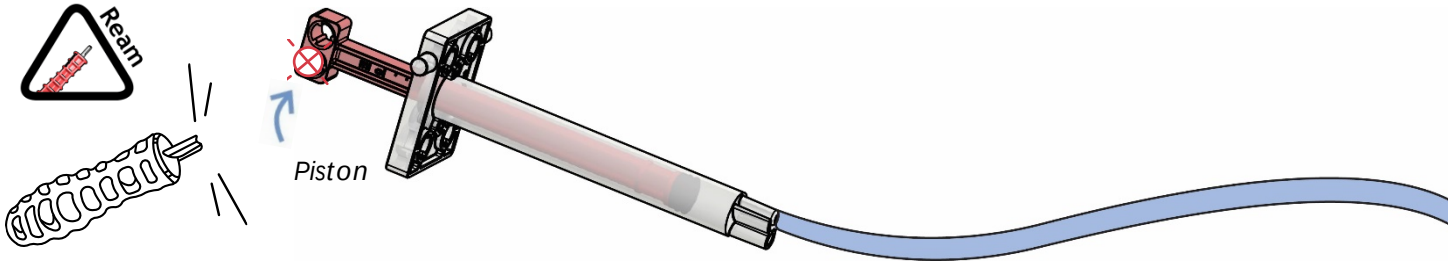
ADDING CYLINDERS



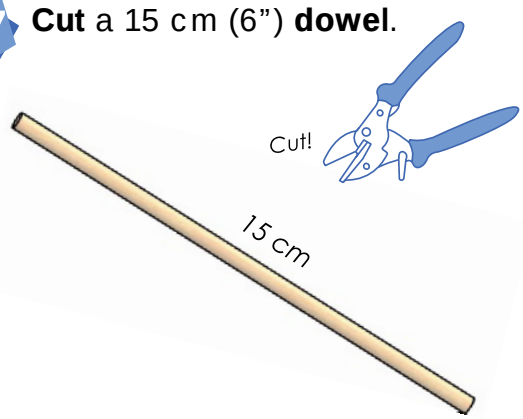
If you are going to do the optional *Fluid Power Lab*, now's the time!

Documents at ***teachergeek.com/learn***

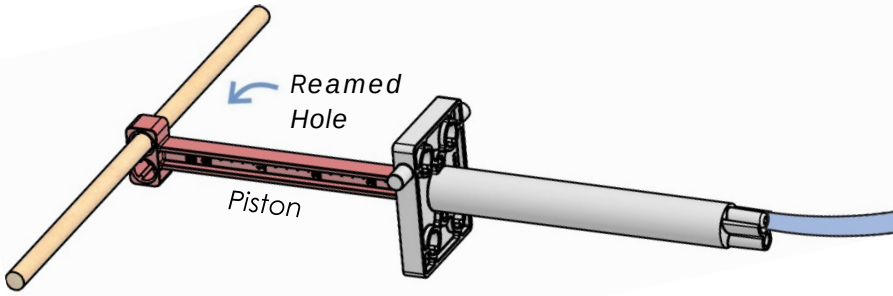
16 **Ream** one of the **holes** on one cylinder's **piston** from a **hydraulic system** from **Step 15**.



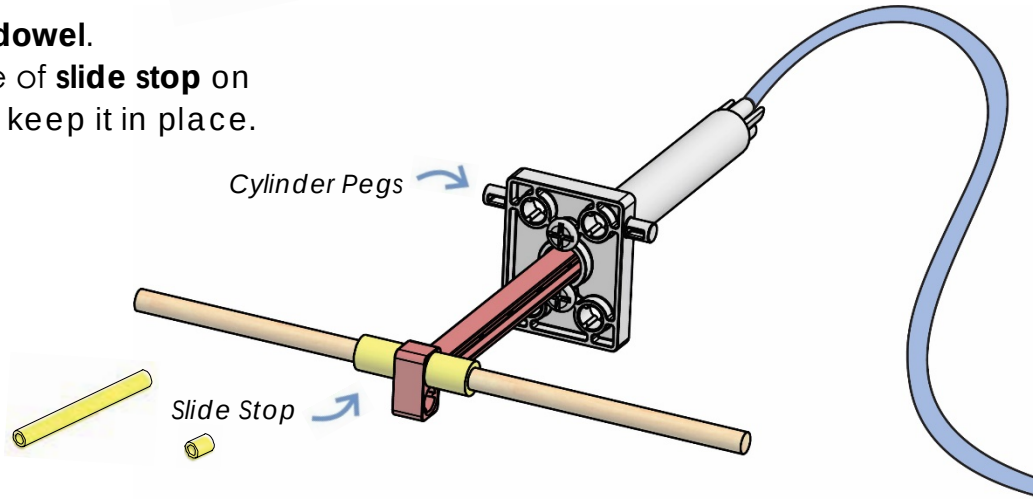
17 **Cut** a 15 cm (6") **dowel**.



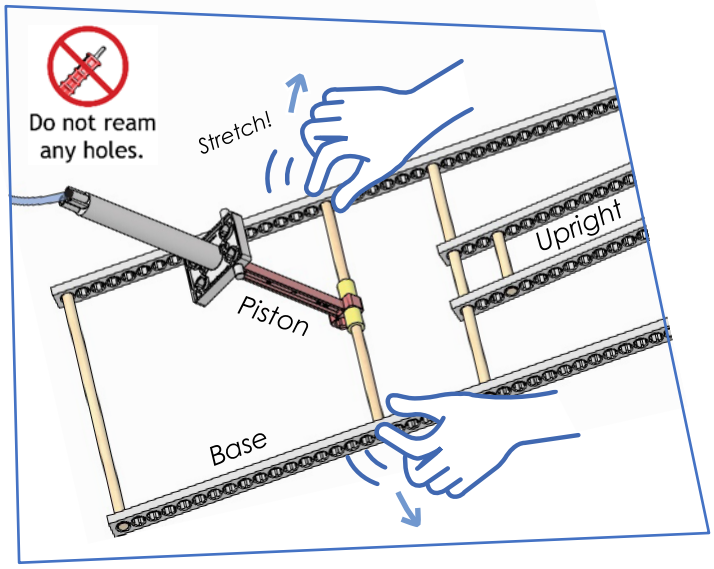
18 **Insert** the **dowel** from **Step 17** into the **reamed hole** from **Step 16**.



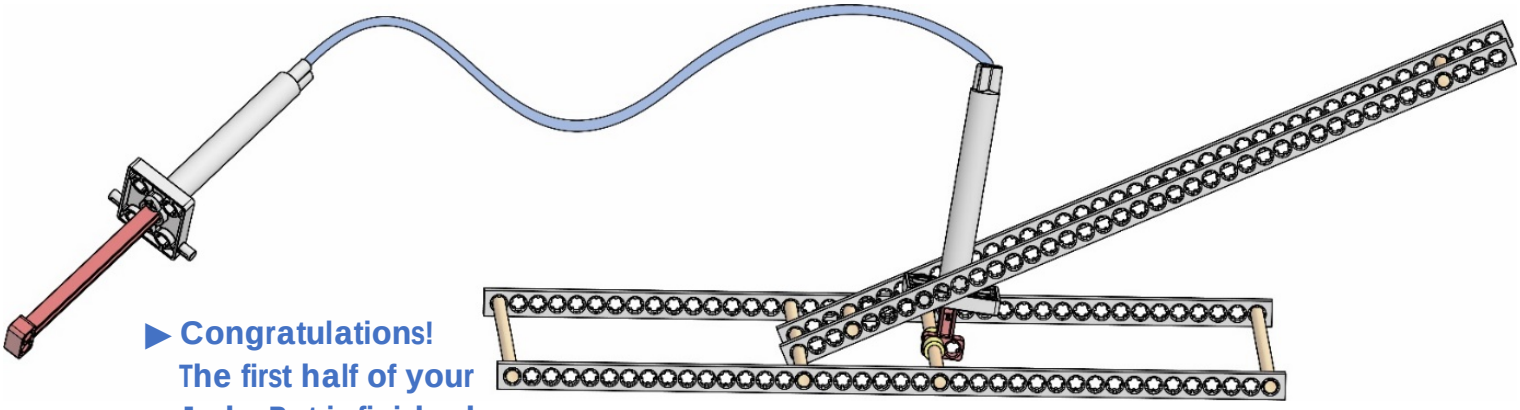
19 Center the piston on the **dowel**.
Slide a 4 mm (0.15") piece of **slide stop** on each side of the **piston** to keep it in place.



20 **Place** the **cylinder** from **Step 19** into the **frame** from **Step 9**. Stretch the frame to **align** the dowel 8 holes from the **upright.**



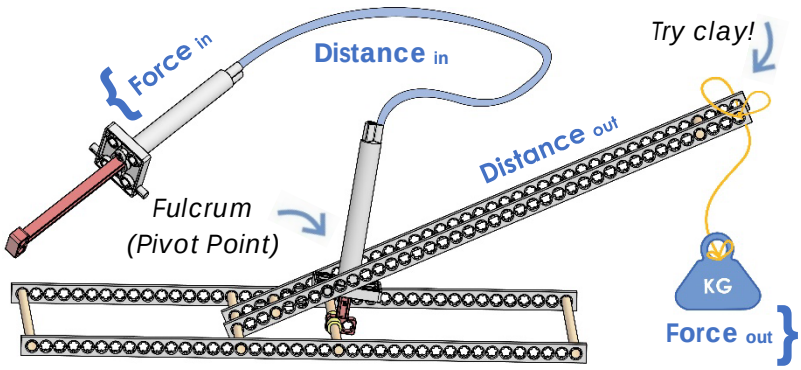
21 **Insert** the **cylinder pegs** between the **upright's** connector strips.



▶ **Congratulations! The first half of your Judo-Bot is finished.**

Test how it moves – use the **hydraulic system** to move the upright up and down. Attach a weight to the upright's end (*piece of clay, cup of pennies*).

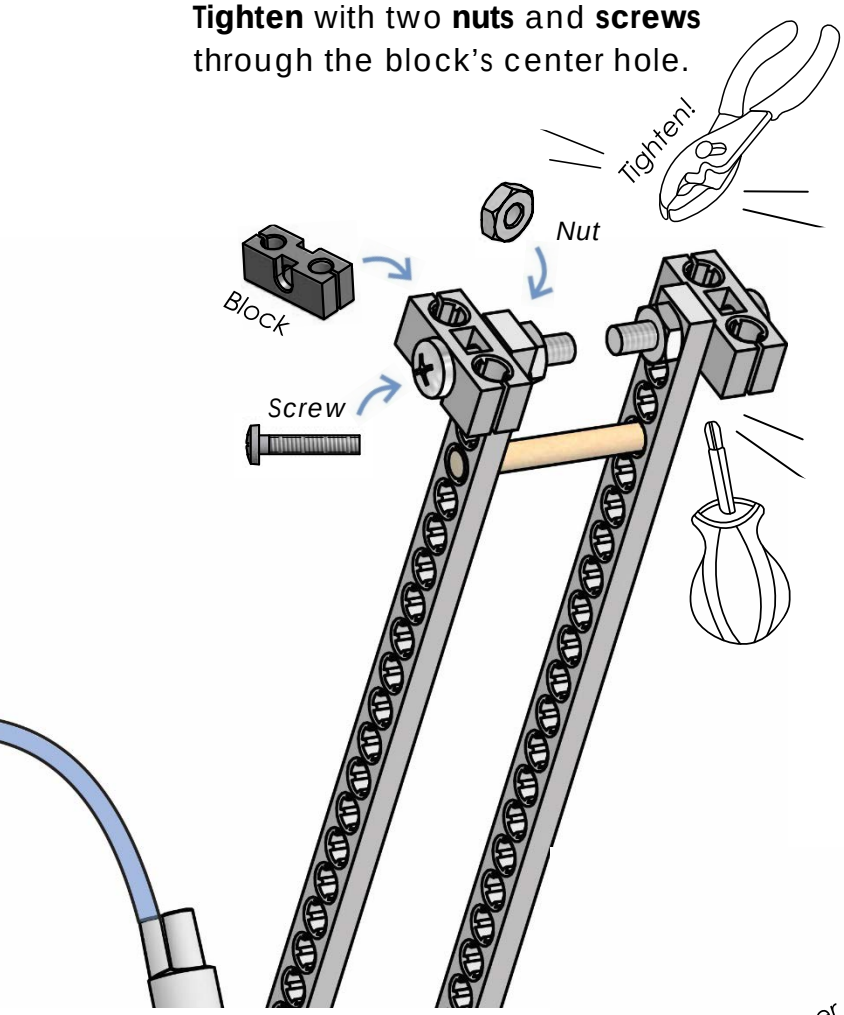
Change the **fulcrum** of your upright's cylinder – what height makes the weight easier to lift?



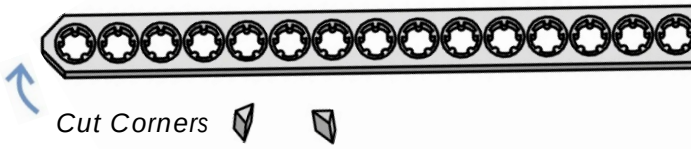
Mechanical Advantage: trading distance for force

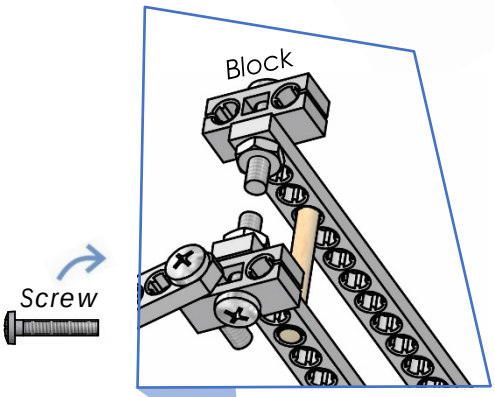
LEVER ARM

22 **Attach** two **blocks** to the top holes of the **upright** from **Step 21**. **Tighten** with two **nuts** and **screws** through the block's center hole.

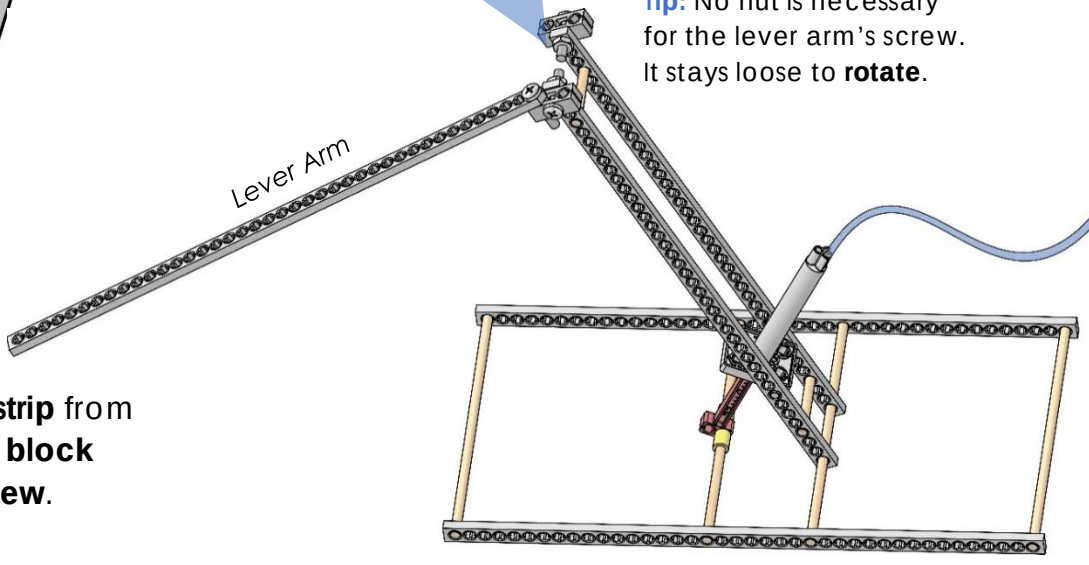


23 **Cut** the **corners** off one end of a **connector strip**.



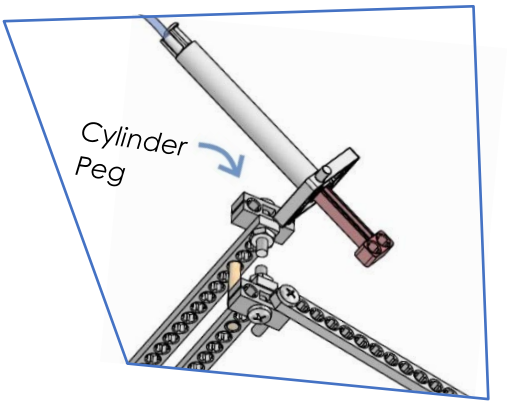


Tip: No nut is necessary for the lever arm's screw. It stays loose to **rotate**.

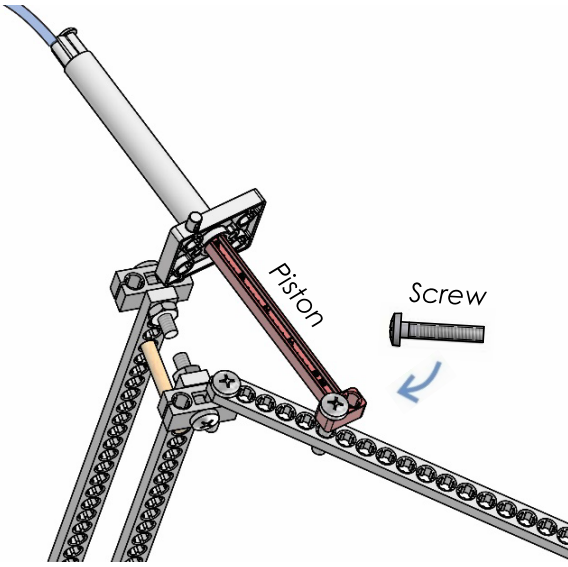


24 **Attach** the **connector strip** from Step 23 to an upright's **block** from **Step 22** with a **screw**.
This is your **lever arm.**

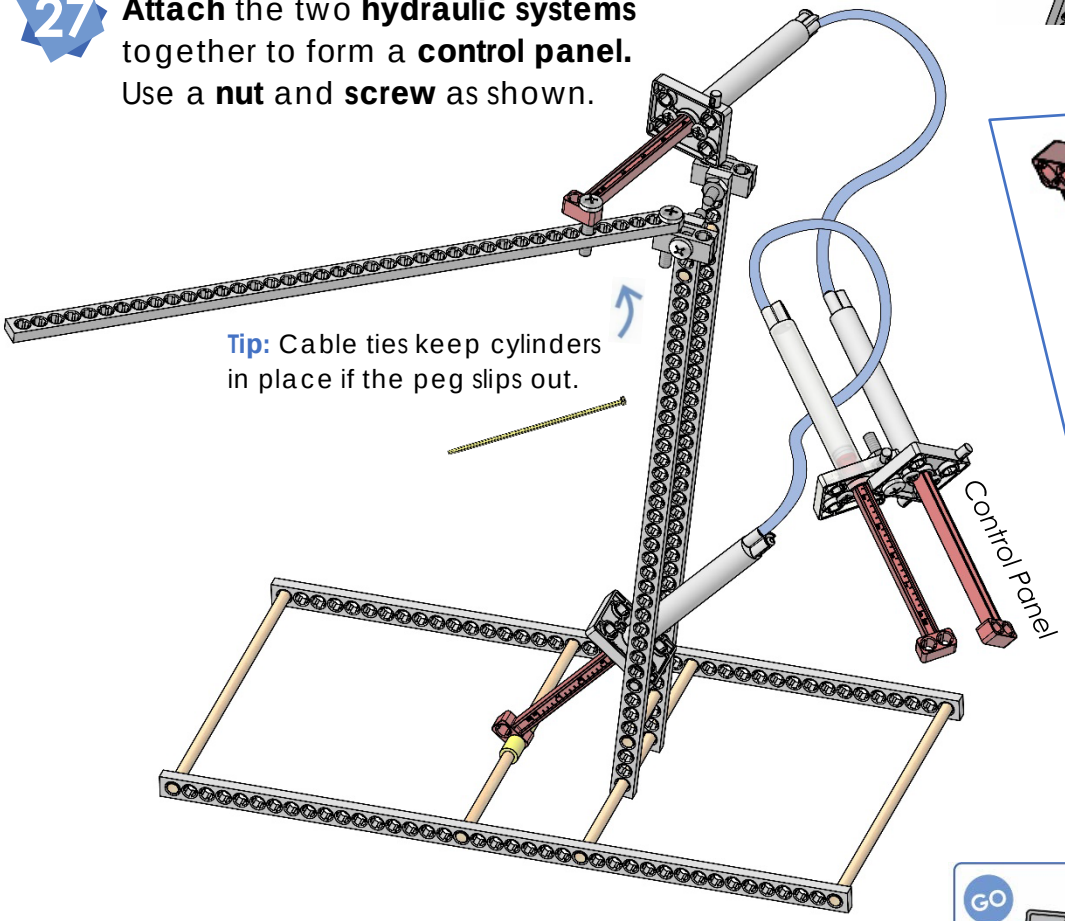
25 **Attach** a **cylinder** from the second **hydraulic system** from **Step 15** to the upright. **Insert** the cylinder **peg** to the **block** as shown.

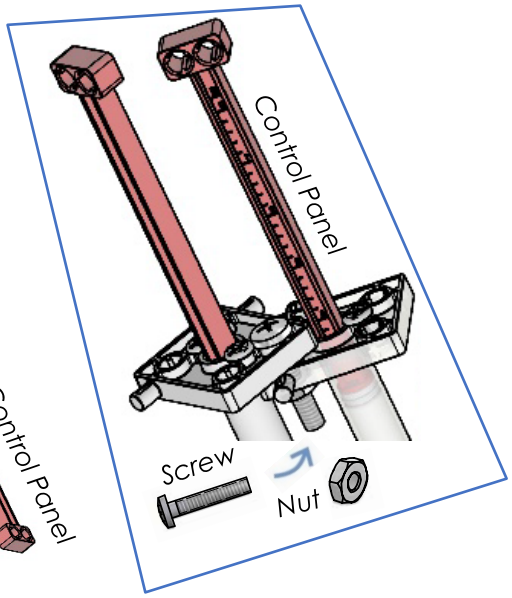


26 **Attach** the **piston** to the **lever arm** with a **screw**.



27 **Attach** the two **hydraulic systems** together to form a **control panel.** Use a **nut** and **screw** as shown.





► Congratulations!

You have built an example Judo-Bot. However, you can make it better!

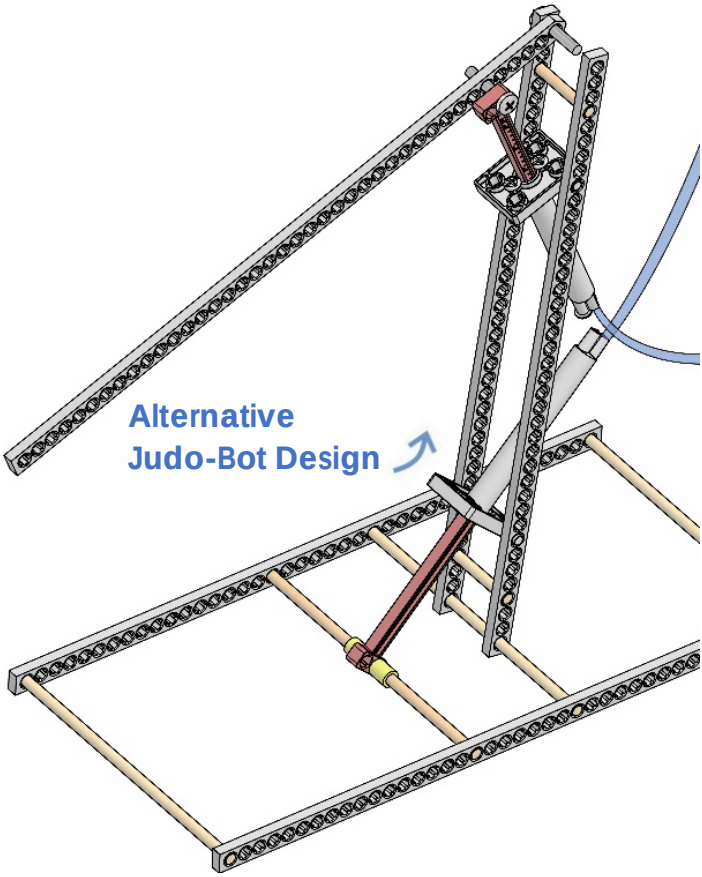
If you are going to do the optional *Judo-Bot Challenge*, now's the time!

Documents at ***teachergeek.com/learn***

DESIGN YOUR JUDO-BOT

This build guide is for an *example* **Judo-Bot** frame.
In the Engineering Challenges, you can design and re-design your build and add end effectors for battle.
Create the ultimate bot to compete in tournaments!
Will you win? **Find out more:** teachergeek.com/learn

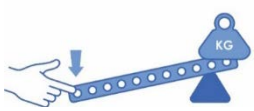
Use found and recycled materials to craft unique end effectors (detachable ends of robot or lever arms) for your Judo-Bot.



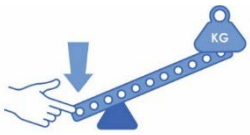
Alternative Judo-Bot Design

Design, Create, Innovate

Your example Judo-Bot doesn't have to look this way. Reposition the **lever arm-cylinder** from **Step 26** to fit in the **upright** or place the cylinder (**fulcrum**) closer or further up the arm. The possibilities are endless!



Applying force a long distance from the **fulcrum** allows just a *little* effort to lift a *large* load.



Applying force a short distance from the **fulcrum** means *more* effort to lift the load a *shorter* distance.