Automata: Putting it all together

Tentative Schedule

18:00 Guest Lecture
18:30 Lab "Putting it All Together": Automata example (The Gymnast)
19:15 Project Time: Form (2-3 person) team; Automata sites and concept sketches
20:00 Email Team Proposal (3-slides: inspirational video and sketches)
20:15 Clean up and Adjourn

Review

Lab 1: Simple Machine I: Levers, Shafts, And Cranks

Hands-on Lab   Homework

- Simple Crank   • Constructed slider-crank mechanism
- Crank 3-bar
- Crankshaft
- Complex Crank

Lab 2: Simple Machine II: Cams, Springs, And Linkages

Hands-on Lab   Homework

- Cam Follower   • Flat folding chair
- Cam Follower Vehicle
- Torsional Linkage
- Multi-jointed Torsional Linkage
- 4-bar linkage walker

Lab 3: Simple Machine III: Ratchets, Drives, And Gearing
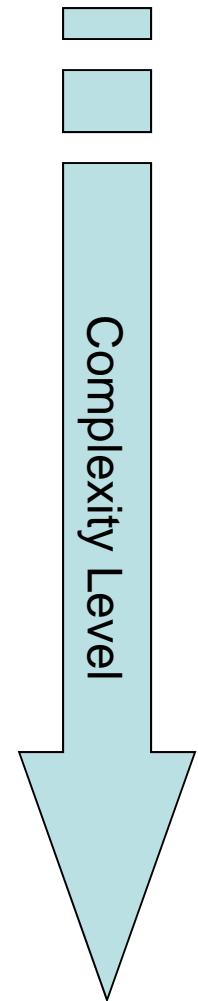
Hands-on Lab   Homework

- Planetary Gears   • Windshield Wiper
- Bevel Gears (and Pin Wheel)
- Worm Gears
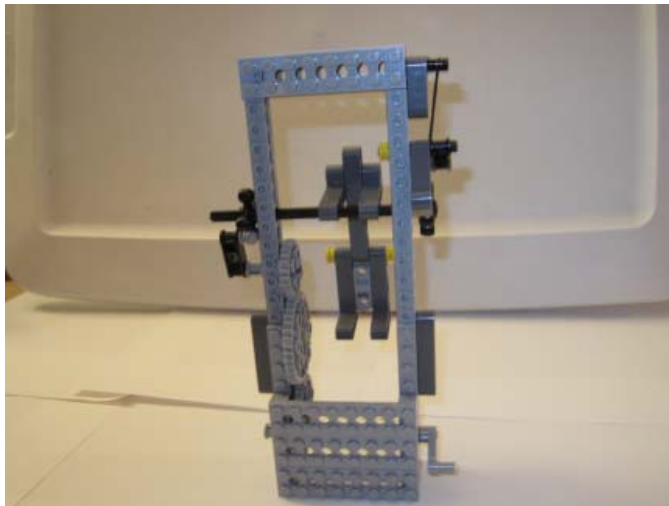- Rack-and-Pinion

Complexity Level

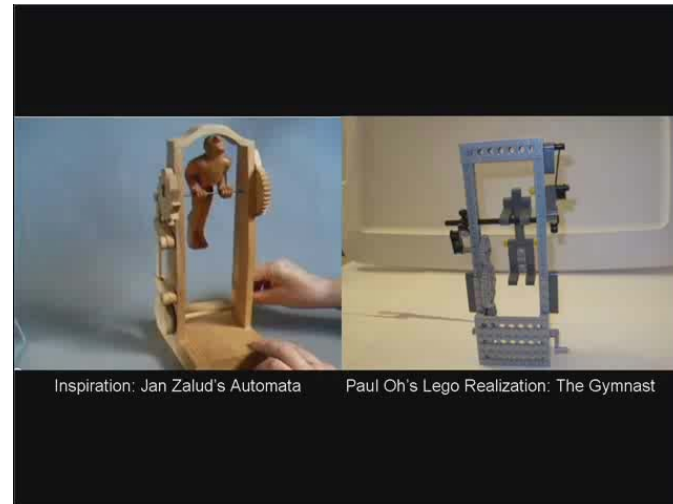Result is a cookbook with fundamental recipes. Now, you can create a meal

- Input: handle crank (Lab 1)
- Cam and follower (Lab 2)
- Follower pushes ratchet (Lab 3)
- Conversion of translation to stepped rotation
- Detent prevents ratchet 2 from reversing
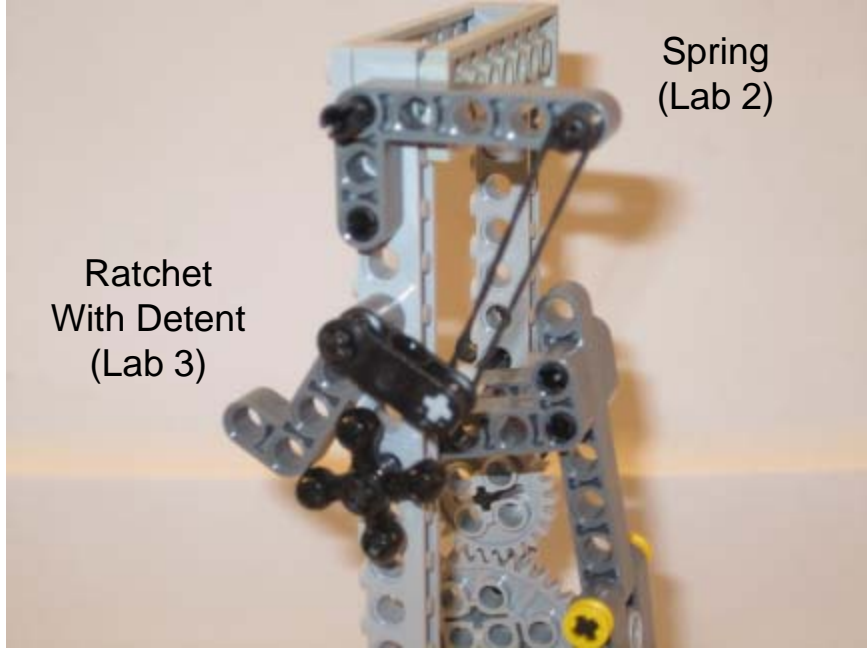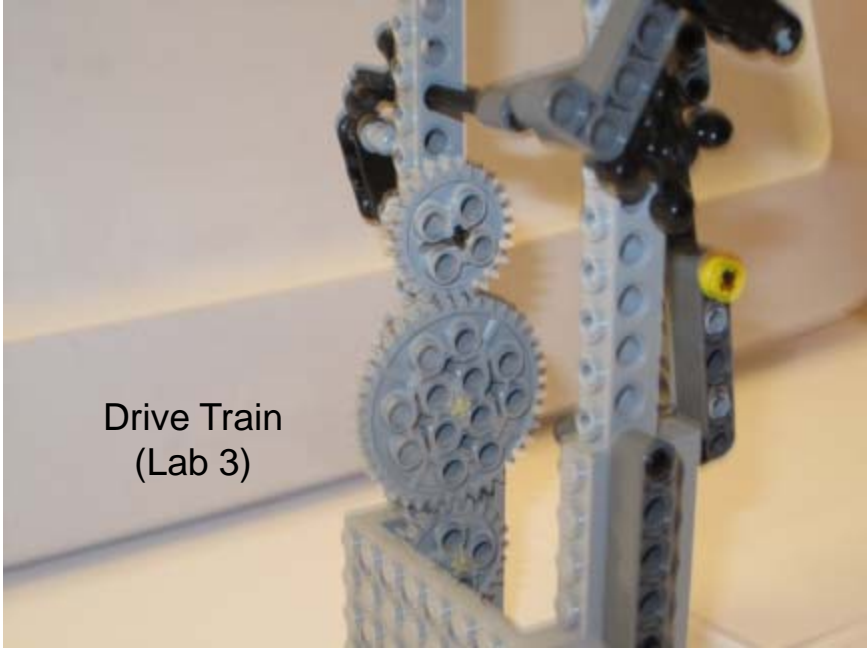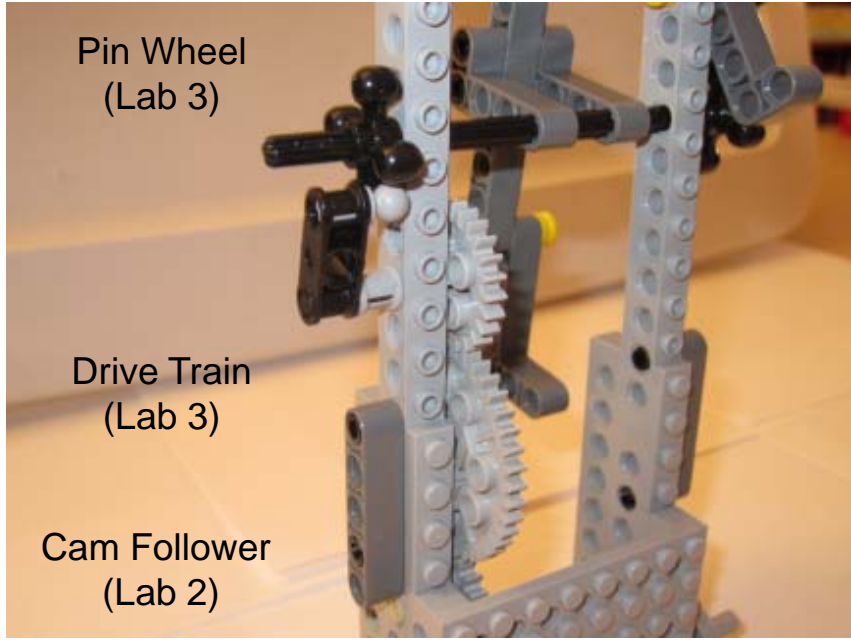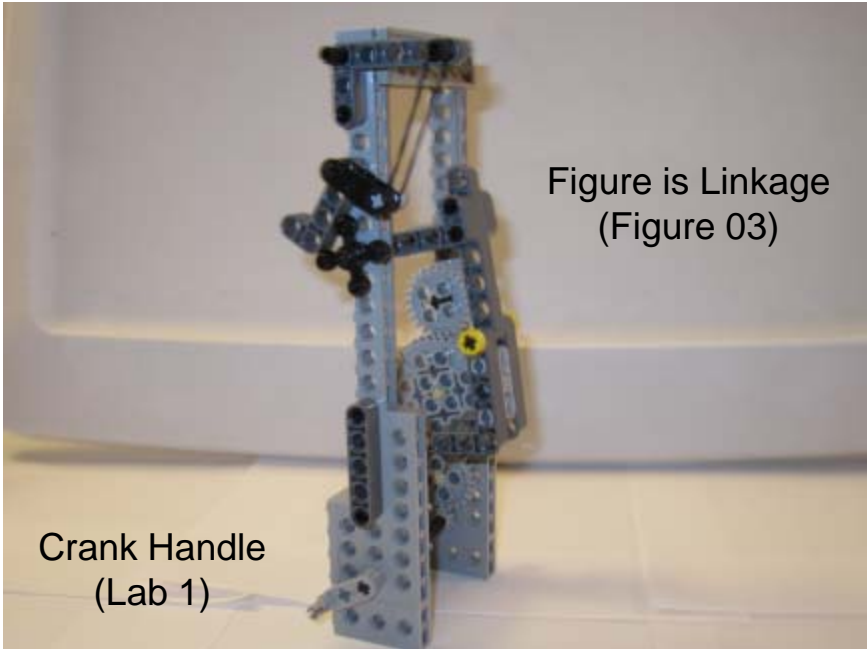- Output: multi-link figure rotates

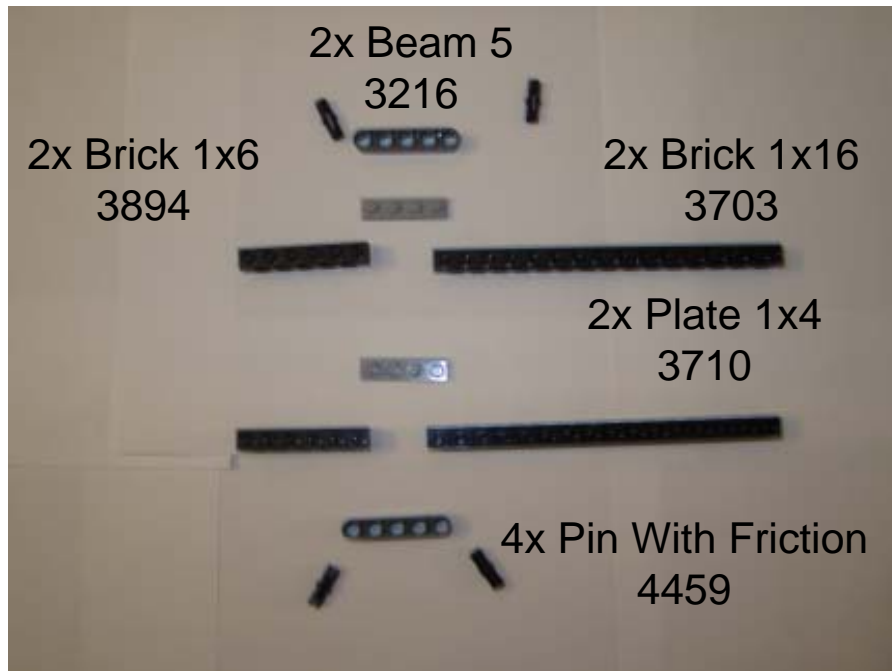http://www.youtube.com/watch?v=zy5B_bzNlD4

Lego-based Automata – The Gymnast

Video

Figure is Linkage (Figure 03)

Crank Handle (Lab 1)

Pin Wheel (Lab 3)

Drive Train (Lab 3)

Cam Follower (Lab 2)

Drive Train (Lab 3)

Spring (Lab 2)

Ratchet With Detent (Lab 3)

Lego-Based Automata: The Gymnast

Step 1: Assemble rails

2x Beam 5
3216

2x Brick 1x6
3894

2x Brick 1x16
3703

2x Plate 1x4
3710

4x Pin With Friction
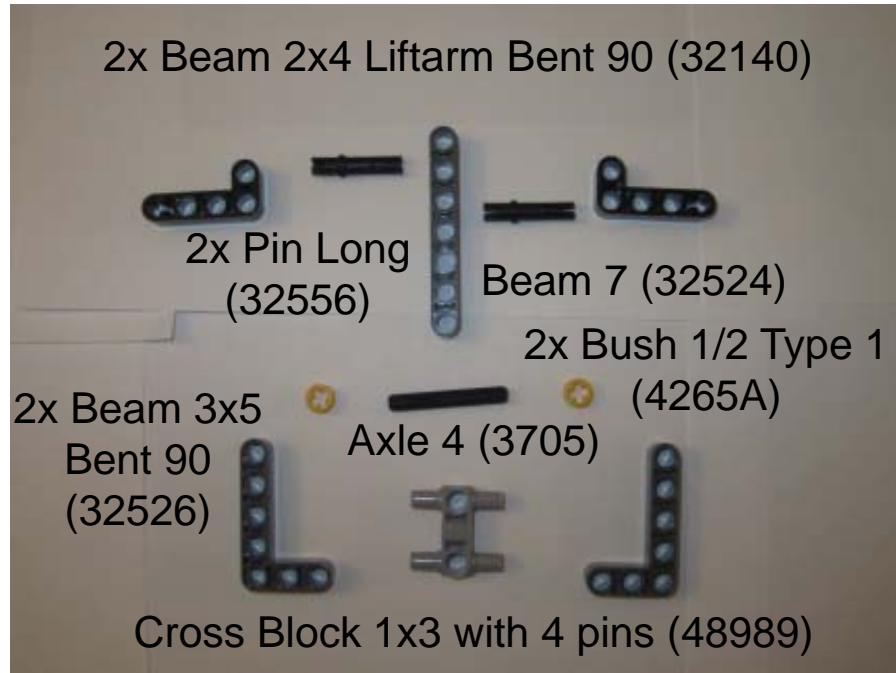4459

Connect the 2 bricks with a plate. Secure connection with a beam. Construct 2 of these

Step 2: Assembly Gear Train
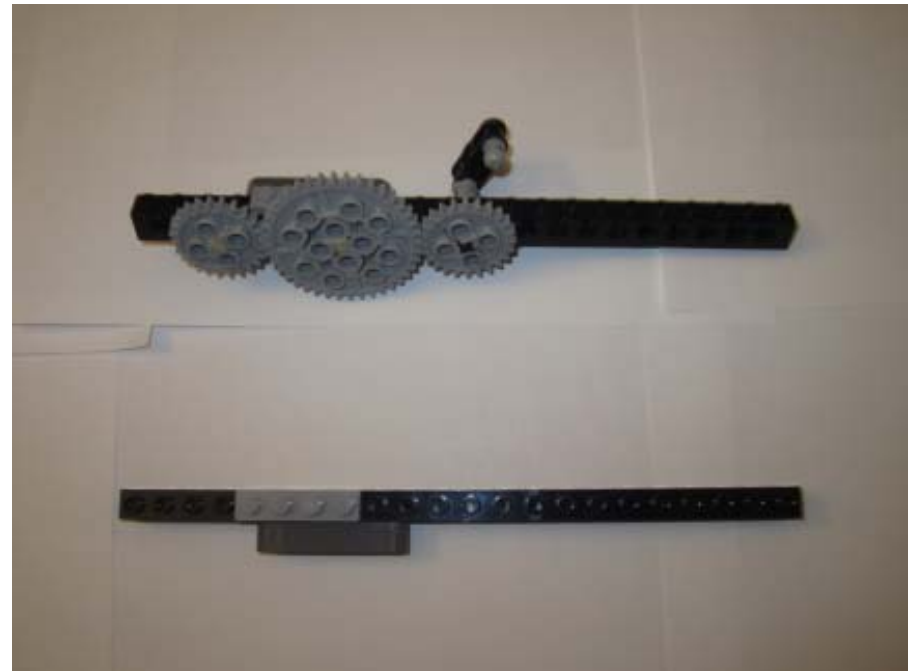
Align and insert first 24T Gear. Mesh and insert 40T Gear. Align second 24T gear and thread Axle-5. Secure with bush and attached cross block. Insert Axle Towball in cross block

Step 3: Construct the gymnast figure

2x Beam 2x4 Liftarm Bent 90 (32140)

2x Pin Long (32556)

Beam 7 (32524)

2x Bush 1/2 Type 1 (4265A)

2x Beam 3x5 Bent 90 (32526)

Axle 4 (3705)

Cross Block 1x3 with 4 pins (48989)

Create upper body by inserting long pins in Beam 7. Create arms by attaching 2x4 liftarms. Create lower body by connecting 3x5 beams to cross block. Attach lower and upper bodies with axle. Secure with 1/2 bushes

Step 4: Attach gymnast to rails

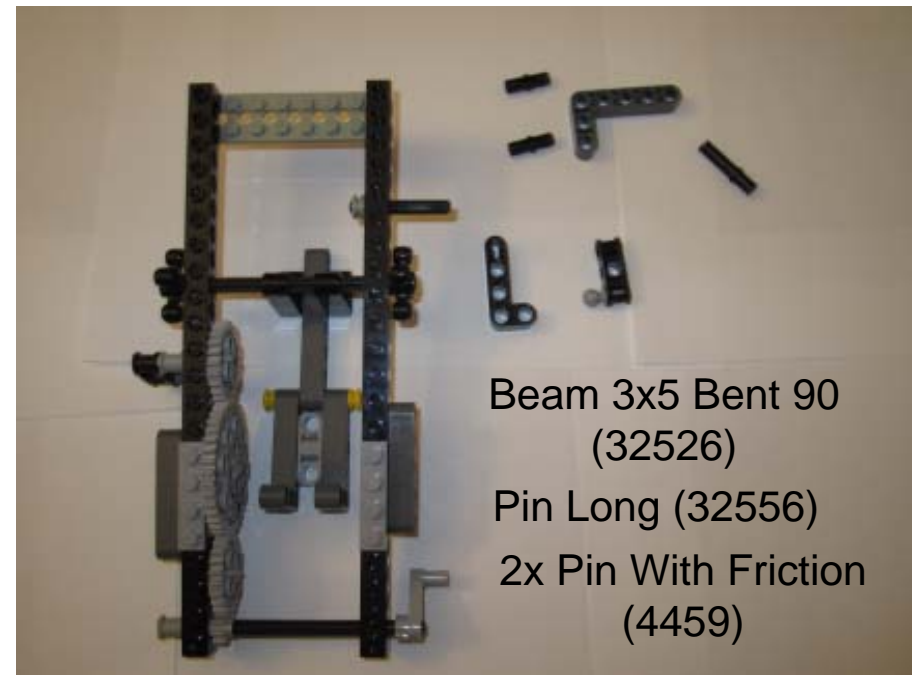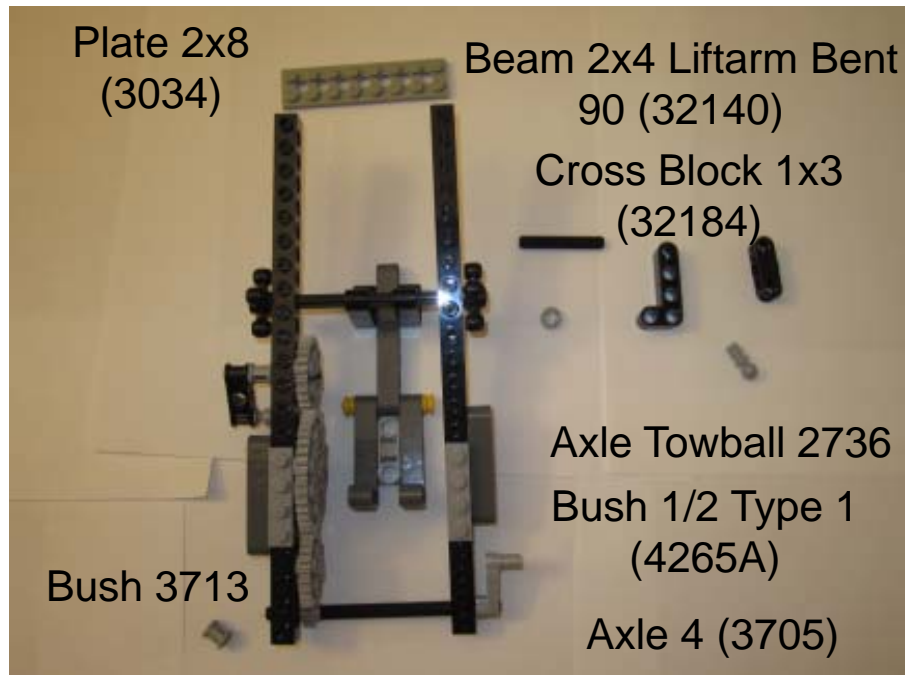2x Axle 10 (3737)   2x Gear 4 Knob (32072)

Gear 8T (3647)

Beam 3x0.5 Liftarm (33299)
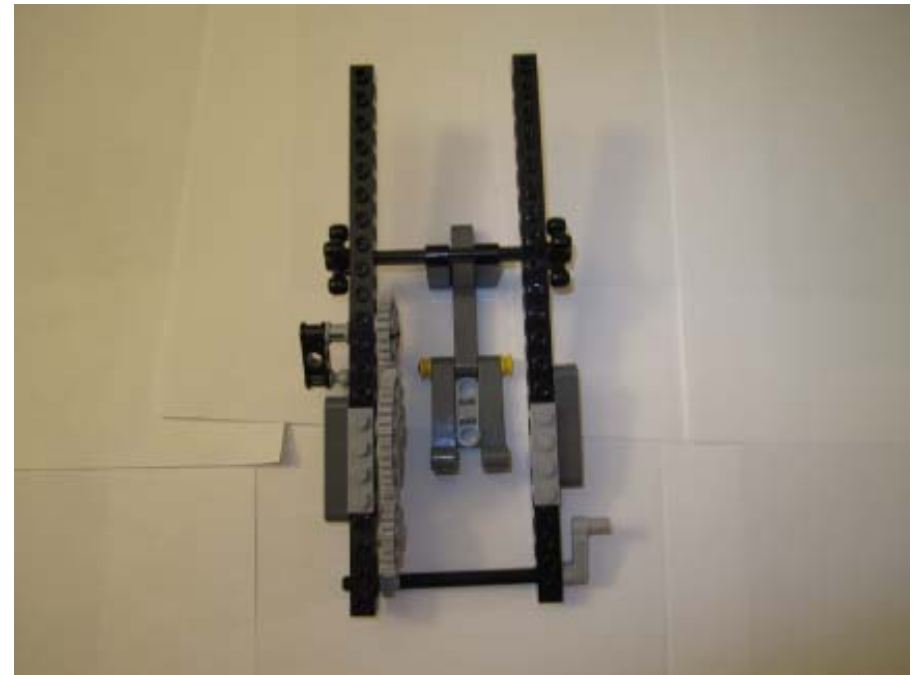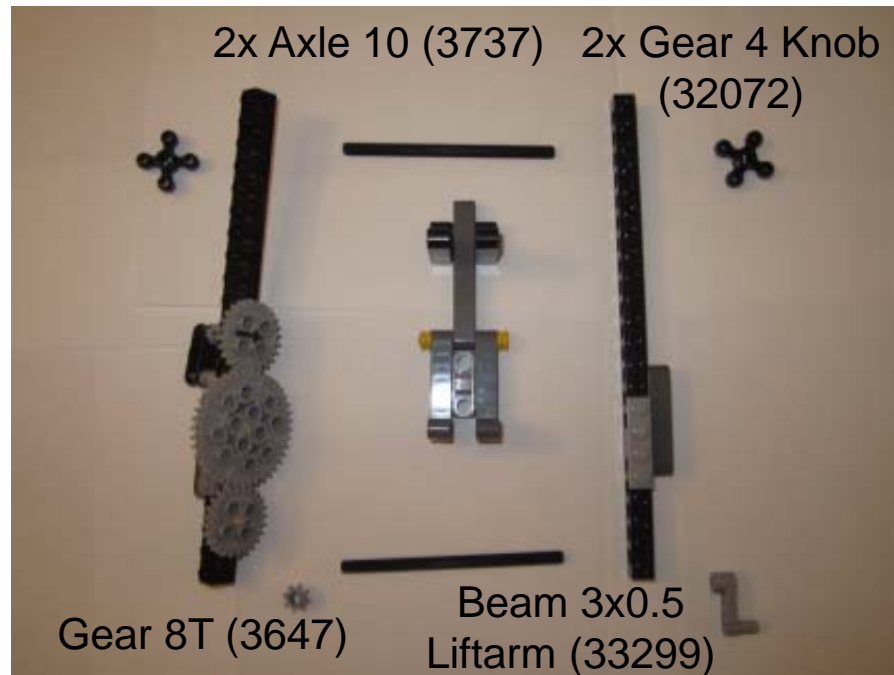
Align and thread Axle 10 through gymnast. Secure with 4 knob.
Align and thread Axle 10 at rail bottom. Mesh 8T gear. Secure at end with 3x0.5 liftarm (handle)

Step 5

Plate 2x8 (3034)

Beam 2x4 Liftarm Bent 90 (32140)

Cross Block 1x3 (32184)

Axle Towball 2736

Bush 1/2 Type 1 (4265A)

Axle 4 (3705)

Bush 3713

Beam 3x5 Bent 90 (32526)

Pin Long (32556)

2x Pin With Friction (4459)

Construct detent by threading Axle 4 through 2x4 liftarm. Secure with 1/2 bush and cross block. Attach towball to cross block. Secure rails with plate. Secure crank axle with bush.

A rubber band will be used for the detent. Attach the 3x5 liftarm to top of rail. Rubber band will be looped to towball and long pin
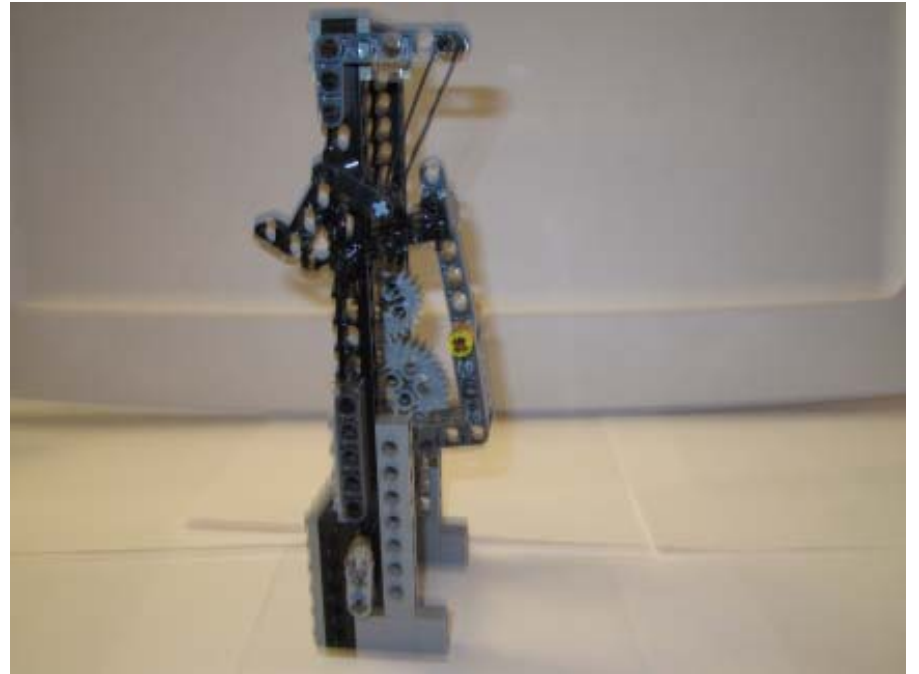
Step 6

4x Plate 2x8
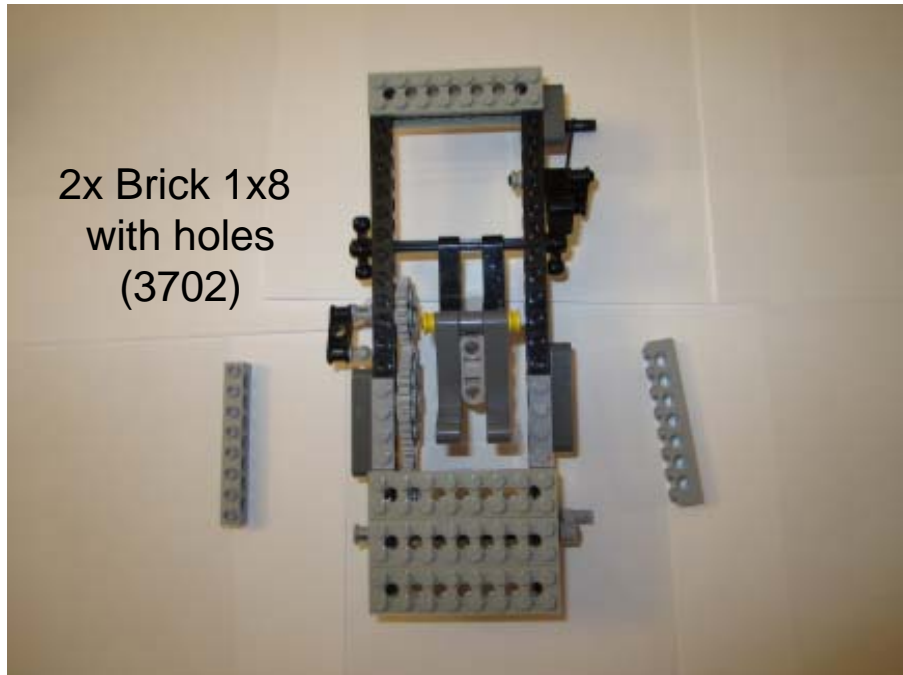(3034)

Rubber Band

2x Brick 1x6
(3894)

6x Brick 1x2
(3004)
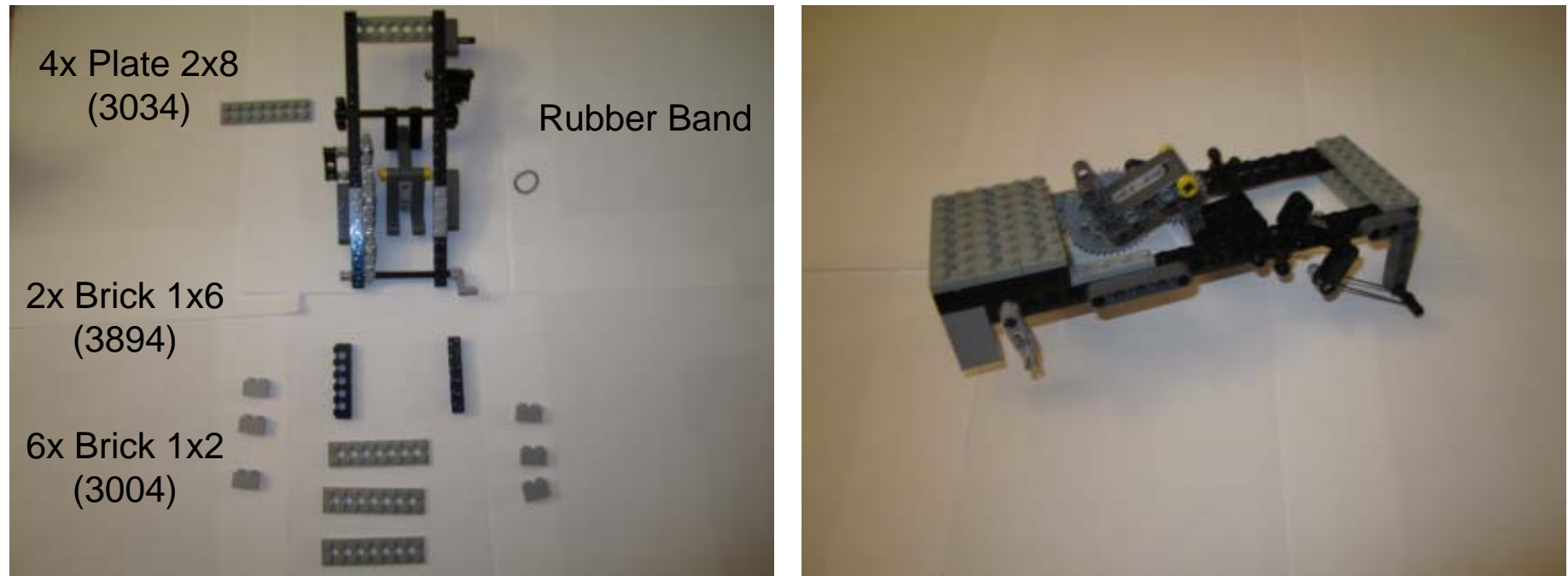
Use 2x8 plates to secure rails at top and bottom. Brace 1x6 bricks at bottom of rail structure. Use 1x2 bricks to complete brace. Loop rubber band at towball and 3x5 liftarm

2x Brick 1x8 with holes (3702)

Secure 1x8 bricks at underneath rails (towards bottom)

Automata Project

19:15 Project Time: Form 2-3 person team. Automata sites and concept sketches

Grading Criteria: NB: Project counts towards 25% to 35% of final grade

- Automata must consist of at least 2 simpler mechanisms e.g. crank and ratchet
- Must be only Lego pieces (can self-purchase extra parts if needed)
- Option to work on a 2-3 person team

  - 15%: Brief explanation of how automata works
  - 15%: Video (20-seconds) compares role model and your creation
  - 25%: MLCAD Build instructions including Bill of Materials
  - 25%: Step-by-step build instructions (photo-based). Bring hardcopy to class next week
  - 20%: Oral Presentation (5-min) showcasing the 4 points above

20:15 Email Team Proposal (3-slides: inspirational video and sketches)

- Web search for Automata that you'd like (and have parts) to reproduce
  - Slide: results of web search
- Concept sketches
  - Slide: scan of concept sketches
- Prototypes: some possible reproductions in Lego
  - Slide: Photos of reproductions, MLCAD constructions