


















# Cup Up and Away 2020: Results

Bharti School of Engineering  
Laurentian University  
Sudbury, Ontario, Canada

Winter 2020

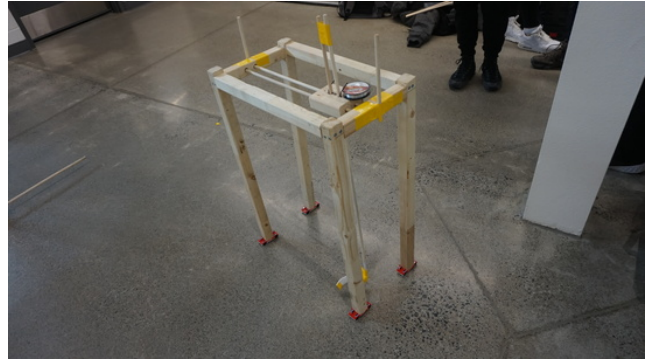
# Prototype results

Group	Performance			Cost		Total Score
	Grid	Total	Score	\$	Score	
1-01*		4	56.7%	\$17.73	81.8%	64.2%
1-02		0	50%	\$36.23	72.1%	56.6%
1-03		0	50%	\$1.26	100%	65%
1-04		0	50%	\$47.84	62.8%	53.8%
1-05		0	50%	\$7.78	94.8%	63.4%
1-06		0	50%	\$26.51	79.8%	58.9%
1-07*		6	60%	\$19.61	80.3%	66.1%
1-08*		0	50%	\$12.92	85.7%	60.7%
1-09*		0	50%			
1-10		30	100%	\$15.49	88.6%	96.6%
1-11		0	50%	\$9.92	93.1%	62.9%
2-01*		0	50%	\$11.66	91.7%	62.5%
2-02*		6	60%	\$26.46	79.9%	66%
2-03		22	86.7%	\$14.61	89.3%	87.5%
2-04*		0	50%			
2-06		0	50%	\$28.69	78.1%	58.4%
2-07		12	70%	\$63.86	50%	64%

\*Penalty for errors in the cost analysis sheet (-15% cost).

# Group 1-01

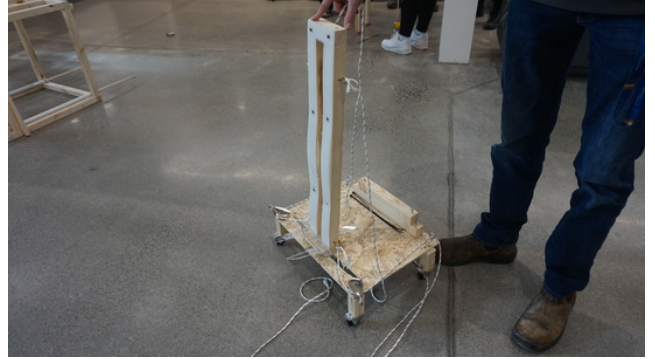
## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Alexandria Moulding Hardwood Dowel 3/8 In. x 48 In. Orange	\$1.74	Length of dowel: 36 inches	400%	\$6.96
Hot Wheels Basic Car - Styles May Vary	\$1.25	Length of dowel used: 36x4	400%	\$5.00
2-in x 4-in x 92-5/8-in (92 5/8-in) Kiln-Dried Whitewood Select Sud	\$2.98	Used 4 to cover each base of the machine	86%	\$2.56
DIY Spool String Transparent Nylon Fishing Line without Elastic Fish Wire Caroj	\$5.32	Length of block used: 5.5 Total length of support: 74 but the width is cut in half so it would be 74/2	32%	\$1.70
Paulin #8 x 1-1/2-inch Steel Flat Head Square Drive Head Wood Screw - Zinc Plated	\$5.98	Line length: 25m Line used: 8m	17%	\$1.02
Great Value 16 Oz. Red Party Cup	\$4.46	# of screws in container: 100 # of screws used: 17	6%	\$0.27
3M Multi-Purpose Duct Tape, 3920-YL, Yellow	\$4.47	# cups: 50 cups # cups used:3	3%	\$0.13
Artistic Wire 22-Gauge Antique Brass, 8-Yards	\$8.28	Amount of tape: 60 feet Amount of tape used: 2 feet	1%	\$0.08
		731.52 cm in the roll 7cm used		
			TOTAL	\$17.73

# Group 1-02

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Rubber Rigid Caster, 1-1/2-in	\$2.99	used 4	400%	\$11.96
KingChain Single Sheave Rope Pulley, 1-1/2-in	\$4.79	used 2	200%	\$9.58
THD 2x2x8 Framing Lumber	\$3.24	used 1 and a half	150%	\$4.86
Everbilt 1/8-inch x50 Feet NYLON DIAMOND BRAID WHITE	\$4.23	used all of it	100%	\$4.23
PLASKOLITE White Twinwall Polypropylene Sheet (18-in x 24-in)	\$9.49	used 115in of 432 in	26%	\$2.47
Hillman 12-in W x 18-in L Plain Cold Rolled Steel Weldable Solid Sheet Metal	\$12.49	used 16in of 216in Sheet	8%	\$1.00
1/4 4x8 Oriented Strand Board	\$9.55	Could make up to 10 Playforms	9%	\$0.86
Paulin M4-.70 x 16mm Class 8.8 Metric Hex Cap Screw - DIN 933 - Zinc Plated	\$0.34	used 2	200%	\$0.68
Paulin M4-0.70 Class 8 Metric Hex Nut-DIN 934 - Zinc Plated	\$0.17	used 2 for the bolts	200%	\$0.34
Paulin#8 x 2-1/2-inch Flat Head Square Drive Construction Screws in Yellow Zinc - 350pc	\$31.48	used 28 of 350pc	0.8%	\$0.25
			TOTAL	\$36.23

# Group 1-03

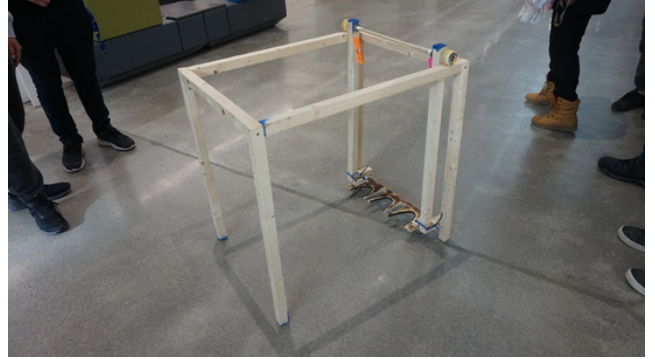
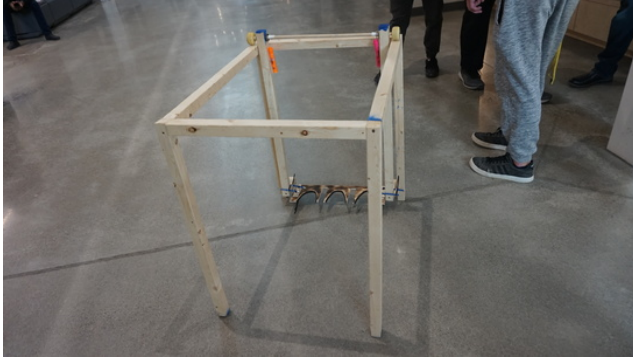
## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Goodfellow 1/4 Inch 4 Feet x 4 Feet Hardboard Handy Panel	\$13.68	Could make 13 devices from this sheet	7.69%	\$1.05
ipg Intertape Polymer Group HVAC Premium 14 MIL Duct Tape 1.88 inch x 60 Yards - (4-Pack)	\$59.32	Used 2.5 ft	0.21%	\$0.12
Everbilt MEDIUM x 420 Feet COTTON TWINE	\$5.33	Used 2 ft	0.95%	\$0.05
Paslode 2,000-Piece 18-Gauge Galvanized Smooth Finish Nails Multi-Pack	\$10.99	Used 6 Nails	0.3%	\$0.03
			TOTAL	\$1.26

# Group 1-04

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
RipStik Casterboard				
Replacement Wheel Set (Pink)	\$29.02	Used both wheels	100%	\$29.02
THD 2x2x8 Framing Lumber	\$3.24	Used 25.1ft of lumber	314%	\$10.17
Kreg Tool Company 2-1/2-inch Coarse Zinc-Plated Steel Square-Head Pocket Screw (50-Pack)	\$7.74	Used 12 of the 50 screws	24%	\$1.86
Alexandria Moulding Hardwood Dowel 1/2 In. x 48 In. Purple	\$2.93	Used 22 3/4' of the dowel	47%	\$1.38
Alexandria Moulding 1/4 inch x 2 Feet x 2 Feet Birch Plywood Handy Panel	\$6.45	Used 1/5 of the Plywood	20%	\$1.29
Commercial Electric 14-inch UV Cable Tie - Black (100-Pack)	\$12.81	Used 10 of the cable ties	10%	\$1.28
Staedtler Norica HB Pencil, 36/Pack	\$11.29	Used 4 of the pencils	11.1%	\$1.25
Paulin 1/2-inch Steel-Regular Spring Lock Washers - Zinc Plated	\$0.30	Used 4 of the washers	400%	\$1.20
Paulin 1/4-inch Plain Steel Washers - Zinc Plated	\$0.12	Used 2 of the washers	200%	\$0.24
Trilene XL Service Spool, Clear 3000 Yards - 8 lbs	\$75.77	Used 5.67 yards, or 17ft	0.19%	\$0.14
			TOTAL	\$47.84

# Group 1-05

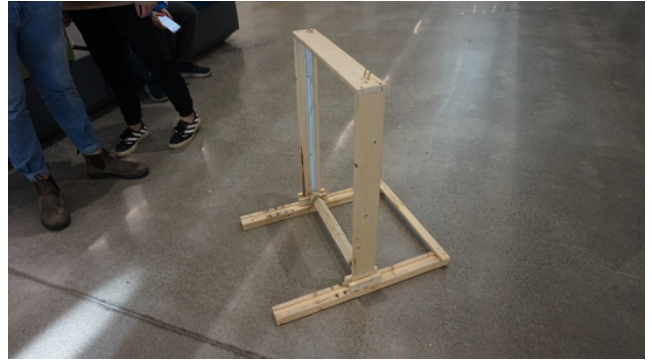
## Prototype

Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
SCOTT 2-Pack Shop Towels	\$4.78	the 2 cardboards of the papertowel were used	100%	\$4.78
Stanley 11" Cable Ties	\$2.98	half of it used	50%	\$1.49
Stainless Steel Strong Metal Wire Hangers	\$12.89	1/10 hangers was needed	10%	\$1.29
The Original Duck Tape Brand Duct Tape, Silver	\$4.97	about 50cm of tape were used to hold parts together	2.75%	\$0.14
			TOTAL	\$7.70



# Group 1-06

## Prototype

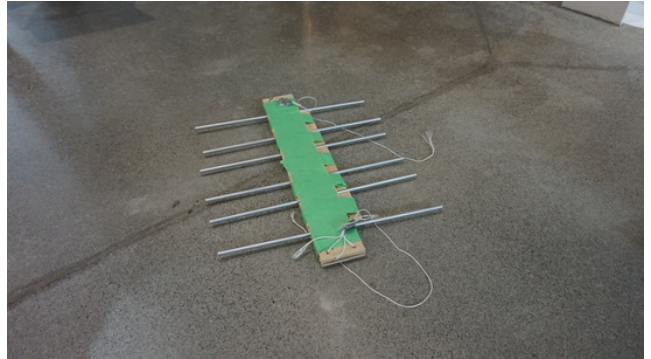
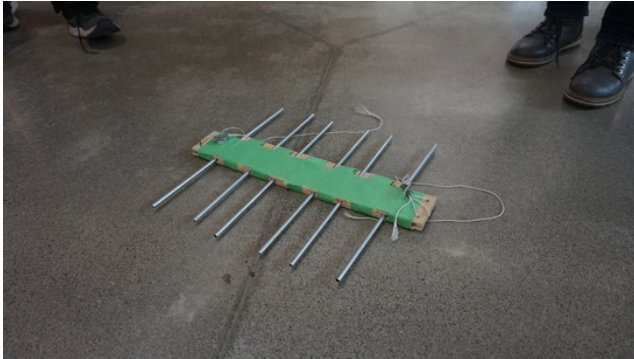


Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Worksavers914 mm (36-inch) Bulk Track for Bifold Door	\$7.07	2 full products	200%	\$14.14
Worksavers Top Pivots	\$4.36	1/2 of 2 packs	100%	\$4.36
THD 1X4X8 MILLSTEAD SPF SDRY	\$2.57	Full use of plank	100%	\$2.57
6 x 1-1/4-inch Flat Head Phillips Drive Coarse Thread screws	\$13.49	13 of 100 used	13%	\$1.75
THD2"x2"-42" WRC Baluster S4S Bevelled Both Ends	\$2.80	18/42 inches used	42.86%	\$1.20
Bead Landing Jute Cord	\$9.99	20/200ft used	10%	\$1.00
2x3x8 Framing Lumber Finger Jointed	\$2.39	3/8 feet used	37.5%	\$0.90
Paulin#8 x 1-1/2-inch Flat Head Square Drive Construction Screws	\$7.95	6 of 100 used	6%	\$0.48
THD1x2x8 Framing Lumber	\$1.45	2/8 feet used	25%	\$0.36
			TOTAL	\$26.76



# Group 1-07

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Paulin 1/8 x 48-inch Steel Round Rod	\$6.38	96 inches used of 48 inches	200%	\$12.76
THD 5.0mm 4x8 Underlaymen	\$13.14	14 feet squared used of 32 feet	50%	\$6.57
Painter's Mate Green Masking Tape, 180-ft x 1.5-in	\$4.99	2 meters of 54.864 meters	4%	\$0.20
Grand and toy general purpose masking tape	\$8.75	50 cm of 55 meters used	0.91%	\$0.08
			TOTAL	\$19.61

# Group 1-08

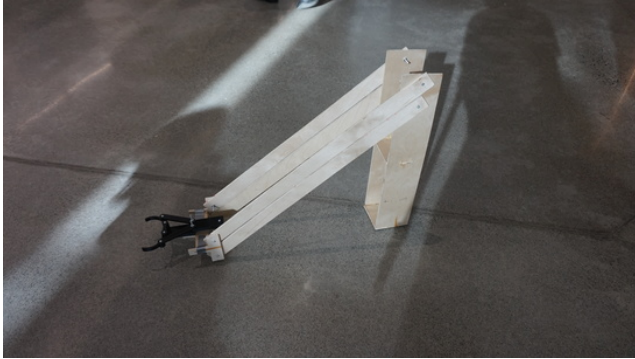
## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
2 Pack 1-1/2" Zinc Loose Pin Narrow Hinges	\$3.39	All used	100%	\$3.39
THD 1x3x6 Select Pine	\$6.20	Half of material used	50%	\$3.10
Schedule 40 1" Slip x Slip PVC Coupling	\$1.09	2 of these used	200%	\$2.18
100 Pack #10 x 1" Flat Head Socket Stainless Steel Tap Screws	\$15.99	Only used 10 screws of this size	10%	\$1.60
3/4" x 10' 100 PSI CPVC Pipe	\$9.99	1 foot used	10%	\$1.00
THD 5.0mm 4x8 Underlay	\$13.14	Only used a 2x1 foot section	6.25%	\$0.82
10 Pack #212 Zinc Plated Small Screw Eyes	\$1.79	Only used 2 of 10	20%	\$0.36
25 pack 3/32" x 2" Zinc Plated Cotter Pins	\$2.69	Used 3	12%	\$0.32
100 Pack #8 x 1-1/2" Pan Head Socket Zinc Plated Tap Screws	\$6.99	Only used 2 screws of this size	2%	\$0.14
Sisal Twine, 2250-ft	\$17.99	12 feet used	0%	\$0.01
			TOTAL	\$12.92

# Group 1-09

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
1/4" 24"x48" plywood	\$11.76	all used	100%	\$11.76
PLA17BK1	\$40.63	174 g used out of 1kg roll	17.4%	\$7.07
6-32 Hex Machine Screw Nut	\$2.97	19 /20 used	95%	\$2.82
6-32x1(1/2)" Machine Screws	\$2.97	17/20 used	85%	\$2.52
6-32 Nylon Washers	\$1.20	all used	100%	\$1.20
No. 5 zink Washer	\$0.72	all used	100%	\$0.72
			TOTAL	\$26.10

# Group 1-10

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
THD 1x2x8 Framing Lumber	\$1.45	Less than 5.5 were used. No waste since even tiny pieces of lumber were used. Exact proportion claimed.	550%	\$7.97
Paulin 5/16-inch x 3/4-inch Hex Head Cap Screw - Zinc Plated - Grade 5 - UNC	\$0.34	8 were used	800%	\$2.72
CANADA TUBING Polyethylene Tubing, 1/4 Inch Inside Diameter X 3/8 Inch Outside Diameter X 25 Ft Coil	\$10.82	6 ft were used	0.24%	\$2.60
Dura Pro Carpenter's Glue, Yellow, 4-L	\$29.99	Less than a quarter of a filled 400 ml bottle was used. Claimed 150 ml.	3.75%	\$1.12
Mastercraft 18 Gauge Brad Nails, 1-1/4-in, 5000-pk	\$23.99	Counted 82 nails used, bumped to 100 to account for waste.	2%	\$0.48
SPECILITE Clothes Hangers, 16 inch 12 Gauge Metal Wire Hanger Bulk for Standard Adult Size, Set of 100	\$76.31	Less than a quarter of a single hanger was used. Claimed 0.3.	0.3%	\$0.23
Flat Washers - Steel - 1/8" - Box of 100 - Zinc Finish	\$2.29	8 were used	0.08%	\$0.18
Marshalltown 1000 Ft. String Line	\$7.94	10 ft were used	1%	\$0.08
Lead Pencils, #2 HB, 10/Pack	\$0.99	Less than half of a pencil was used. One half pencil claimed.	5%	\$0.05
JAM Paper Coloured Standard Paper Clips, Small, Green, 50000/Pack (371332133)	\$1319.99	1 was used	0%	\$0.03
Paulin #6 x 1-5/8-inch Drywall Screws Universal Thread - 5000 pcs/box	\$57.19	2 Screws were used	0.04%	\$0.02
			TOTAL	\$15.49

# Group 1-11

## Prototype

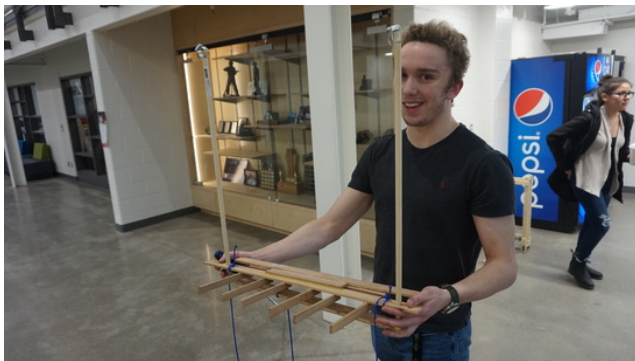


Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Reel 7x7 Galvanized Cable, 1/8-in x 500-ft	\$0.29	25 Feet of cable needed	2500%	\$7.25
Barrette 1X3X12' SPF SDRY #1 PREMIUM	\$2.96	8 ft used	75%	\$2.22
Party Plastic Adjustable Disposable Drinking Straw Assorted Color 100pcs	\$12.99	3.5 straws needed	3.5%	\$0.45
			TOTAL	\$9.92



# Group 2-01

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Poplar Craft S4S 1/4x2x4 Feet	\$2.57		250%	\$6.42
Hardwood Dowel 1/2 In. x 48 In.	\$2.93		100%	\$2.93
Mini Hose Clamp, 410 Stainless Steel, 7/32 In. To 5/8 In., (10-Pack)	\$6.23	Only used 2 hose clamps	20%	\$1.25
Stanley Bostitch Glue Gun Sticks, 24/Pack	\$10.29	only one glue stick used	4.16%	\$0.43
LePage Express Quick Dry Wood Glue	\$13.97		2%	\$0.28
1/8" x 75' Diamond Braid Polypropylene Utility Cord	\$3.78		5%	\$0.19
Paulin 8X2 1/2 inch Flat Sock Wood Screw 250Pc	\$20.76	only used 2 screws	0.8%	\$0.17
			TOTAL	\$11.66

# Group 2-02

## Prototype

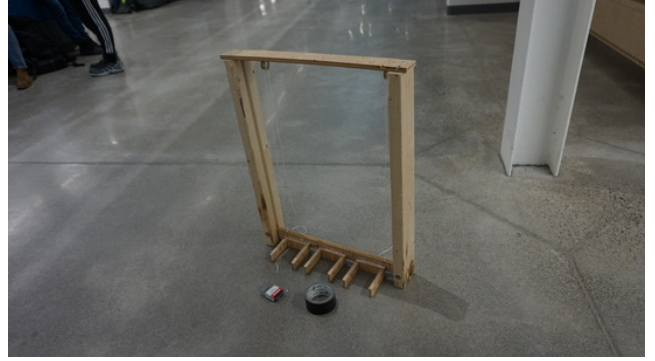


Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Alexandria Moulding Metal Table Leg White 4-3/8 inch	\$11.76	Was used in entirety	100%	\$11.76
IPEX HomeRite Products ABS PIPE 1-1/2 inches x 3 ft CELL CORE	\$5.78	Was used in entirety	100%	\$5.78
Split Key Rings 1.25" 10/Pkg-Nickel	\$36.13	1 was used out of 10 total	10%	\$3.61
DricoreSubfloor membrane panel 23.25 inch x 23.25 inch	\$5.97	Was used in entirety	50%	\$2.98
Kreg Tool Company #8 1-1/4-inch Square Maxi-Loc Head Coarse Zinc-Plated Steel Pocket-Hole Screw (100-Pack)	\$7.46	8 were used out of 100 total	8%	\$0.60
12-14x1-1/2" Drywall Anchor	\$2.98	2 were used out of 10 total	20%	\$0.60
Horizon Group Usa Assorted Sizes Wood Dowels	\$1.00	5 were used out of 10 total	50%	\$0.50
Horizon Group Usa Wood Craft Sticks	\$1.00	13 sticks were used out of 50 total	26%	\$0.26
The Original Duck Tape Brand Duct Tape	\$4.97	2 ft were used out of 20 yards total	3%	\$0.15
Darice Hemp Cord Ball Natural 10# 400Ft	\$11.91	3 ft were used out of 400 ft total	0.75%	\$0.09
10M Electrical Insulating Tape	\$6.32	12.7 cm of tape was used out of 10 m total	1.27%	\$0.08
AdTech Mini Glue Sticks	\$10.97	1/2 a glue stick was used out of 100 total	0.5%	\$0.05
			TOTAL	\$26.46



# Group 2-03

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
1 Pack 3/4" Nickel Swivel Eye Single Pulley	\$2.99	we used two pulleys	200%	\$5.98
2' x 4' x 1/2" (11 mm) Good One Side Fir Plywood	\$16.99	we used a square of 1' by 2'	25%	\$4.25
12 Pack 4" All Temperature Mini Glue Sticks	\$3.99	we used 4 sticks out of 12	33.33%	\$1.33
6 Pack 1/2" Nylon Cable Clamps	\$1.99	we used 4 out of the 6 clamps	66.67%	\$1.33
2-inch x 4-inch x 8 ft. SPF Dimensional Lumber	\$3.40	we used 2.5 ft out of 8 ft	31%	\$1.05
100 Pack #6 x 1-1/4" Bugle Head Self Drilling Drywall Screws	\$5.99	6 screws out of 100	6%	\$0.36
420' Medium Cotton Twine	\$5.29	we used 15 feet of string	3.57%	\$0.19
Blue 60mm x 55M Poly Sheathing Tape	\$11.99	we used 0.5 m out of 50 m	1%	\$0.12
			TOTAL	\$14.61

# Group 2-04

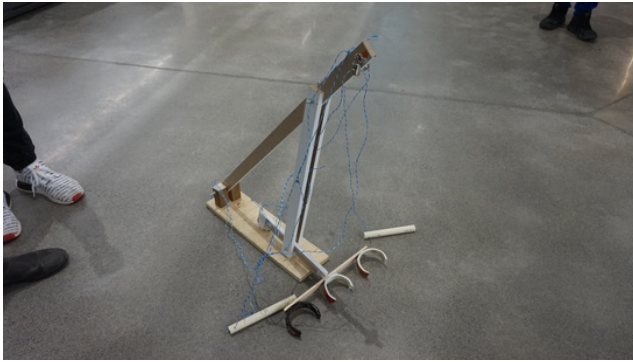
## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
THD 18 inch L x 18 inch W x 24 inch D Large Moving Box	\$2.97		300%	\$8.91
Scotch 700 Commercial Grade Vinyl Electrical Tape	\$3.97		100%	\$3.97
CROSS AXLE 10M [not an approved website]	\$0.23		600%	\$1.38
Ultimaker Black Tough PLA - 2.85mm (0.75kg) [not an approved website]	\$49.95	only used 20 g	2.66%	\$1.33
HUB 11,2 X 7,84 [not an approved website]	\$0.14		800%	\$1.12
Technic, Brick 1 x 14 with Holes [not an approved website]	\$0.11		700%	\$0.77
CONNECTOR PEG W. FRICTION [not an approved website]	\$0.08		800%	\$0.64
Black Technic, Brick 1 x 16 with Holes [not an approved website]	\$0.08		700%	\$0.56
1/2 BUSH [not an approved website]	\$0.08		700%	\$0.56
CONNECTOR PEG [not an approved website]	\$0.08		400%	\$0.32
2M CROSS AXLE W. GROOVE [not an approved website]	\$0.09		300%	\$0.27
Gtermann Sew-All Polyester Thread, 110yd. [not an approved website]	\$1.99		10%	\$0.20
CROSS AXLE 3M [not an approved website]	\$0.08		200%	\$0.16
Yellow Technic Wedge Belt Wheel (Pulley) [not an approved website]	\$0.03		400%	\$0.12
Red Technic, Axle Connector 2L (Smooth with x Hole + Orientation) [not an approved website]	\$0.01		800%	\$0.08
Blue Technic, Liftarm 1 x 3 Thin [not an approved website]	\$0.02		400%	\$0.08
Light Bluish Gray Technic Bush [not an approved website]	\$0.01		700%	\$0.07
Black Technic, Axle 6 [not an approved website]	\$0.01		400%	\$0.04
			TOTAL	\$20.58

# Group 2-06

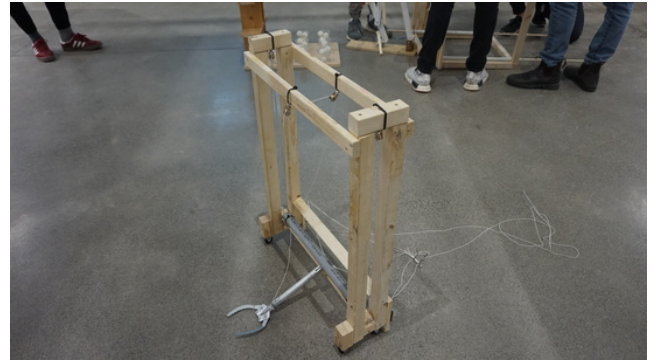
## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
5/8-inch x 1 1/2-inch x 96-inch Modern MDF Painted Decosmart Fibreboard Casing - 8ft	\$8.67	1 full board plus 2 extra feet of another	125%	\$10.84
Mini Hockey Stick - assorted colours	\$3.00	used 2 to make parts	200%	\$6.00
2 pack 1/2 inch Single Swivel Pulley	\$4.99	used 2 pulleys	100%	\$4.99
Alexandria Moulding Finger Jointed Pine Trim 5/16 In. x 1-1/16 In. x 7 Ft.	\$6.21	used 14" (could make 6)	16.67%	\$1.04
Great Value Flaked Light Tuna	\$1.00		100%	\$1.00
3/4" x 10' 100 PSI CPVC Pipe	\$9.99	1 foot used	10%	\$1.00
1/4 x 2 1/2 Zinc Hex Bolt	\$0.45	used 2	200%	\$0.90
1/4" x 4-1/2" #5 Zinc Plated Coarse Hex Bolt	\$0.89	used 1	100%	\$0.89
1/4-inch -20 Finished Hex Nut - Zinc Plated - Grade 2 - UNC	\$0.12	used 4	400%	\$0.48
#8 x 1-inch Round Washer Head Square Drive Particle Board Screws in White - 100pcs	\$14.50	used 3	3%	\$0.43
1/4 x 1 1/2 Zinc Hex Bolt	\$0.30	used 1	100%	\$0.30
MicroPro Sienna 2 x 2 x 8' Treated Wood	\$4.55	used half a foot (could make 12)	6.25%	\$0.28
25 pack 3/32" x 2" Zinc Plated Cotter Pins	\$2.69	Used 2	8%	\$0.22
#8 x 2-1/2-inch Flat Head Square Drive Construction Screws in Yellow Zinc - 100pcs	\$11.47	used 1	1%	\$0.11
Everbilt 1/2 Inch Zinc Plated Small Screw Eye (12-Pack)	\$1.70	used 1	6.25%	\$0.11
Parcel Twine, 5000-ft	\$44.99	used 10 ft	0.2%	\$0.09
24mm x 55M All Purpose Masking Tape	\$2.79	Used 0.3 m	0.55%	\$0.02
			TOTAL	\$28.69

# Group 2-07

## Prototype



Product Description	Full Cost	Justification for cost	Proportion of Total	Proportional Cost
Nifty Nabber 36-inch Grabber	\$22.98	Used 1	100%	\$22.98
1-1/4 inch Soft Rubber Rigid Caster with 30 lb. Load Rating	\$2.52	Used 4	400%	\$10.08
1/2 inch Single-Sheave, Fixed-Eye Rope Pulley - 2-Piece	\$4.28	Used 2 packs of 2	200%	\$8.56
PVC Plain End Pipe	\$18.98	Used 2/10 ft	20%	\$3.80
OOK Magnetic Ceramic Block, 7/8 x 1-7/8-in	\$3.49	Used 1	100%	\$3.49
2x2x8 Framing Lumber	\$3.24	Used 1	100%	\$3.24
1x2x8 Framing Lumber	\$1.45	Used 2	200%	\$2.90
Hardwood Dowel 3/4 In. x 48 In. Red	\$4.51	Used 24/48 in	50%	\$2.25
Armor Coat Quick-Setting Epoxy Adhesive, 28.4-mL	\$6.99	Used 8/28.4mL	32.26%	\$2.25
#6 x 1-1/2-inch Steel Flat Head Square Drive Head Wood Screw - Zinc Plated	\$5.88	Used 22/100	22%	\$1.29
6X1 Flat Socket Hd Tapping Screws	\$2.97	Used 8/24	33.33%	\$0.99
8 Inch Xtreme Cable Tie Blk 20/bag	\$3.17	Used 6 of 20	30%	\$0.95
#1 1-1/8 Inch Zinc plated Small Screw Eye (10-Pack)	\$2.16	Used 4 of 10	40%	\$0.86
Marshalltown 1000-ft White Nylon Mason Line	\$20.99	Used 10/1000 ft	1%	\$0.21
			TOTAL	\$63.86