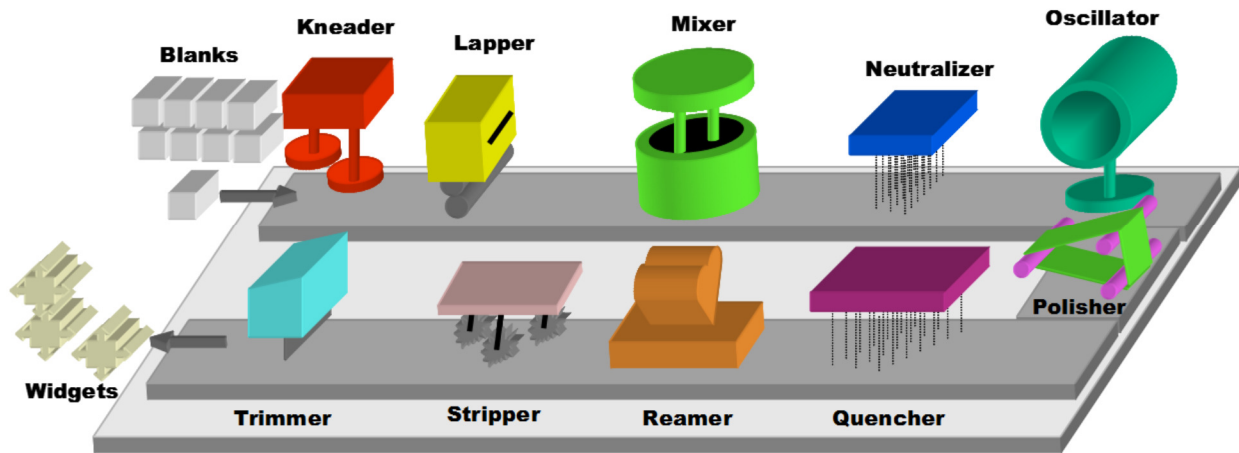# The Widget Factory

A small manufacturing company named *Widgets R Us* has ten employees to operate ten different machines used in the manufacturing of widgets. Starting with a blank, widgets are made in ten processing steps with each step being performed using one of the ten machines as shown in the figure below.

The following table gives the costs of assigning each one of the ten jobs to each of the ten employees. For example: The best person for the *Stripper* is *Francis* and this also happens to be the job that *Francis* is best at. On the other hand *Harry* is the best person for running the *Lapper* but the job that Harry is best at is the *Neutralizer*.

	Alice	Bill	Chris	Dana	Erin	Francis	Gina	Harry	Ilene	Jean
Kneader	152	100	102	82	46	124	67	52	124	153
Lapper	169	136	129	119	100	122	80	43	85	113
Mixer	108	61	59	43	29	83	26	39	101	127
Neutralizer	126	93	85	76	65	84	35	1	73	102
Oscillator	94	47	44	30	32	72	21	48	101	125
Polisher	91	51	44	36	42	64	11	42	91	115
Quencher	171	164	150	152	150	114	106	84	43	57
Reamer	102	98	81	88	100	47	47	51	34	56
Stripper	42	54	35	56	91	21	52	85	90	101
Trimmer	175	178	162	167	170	119	123	105	47	46

a. Find the assignment of jobs to employees that results in the smallest (minimal) total cost using Munkres' Assignment.

b. Compare the total cost from (a) with the cost obtained by a greedy assignment starting with Harry getting assigned to the neutralizer. At each step choose the next lowest available cost. (A cost is available if the job and worker of its row and column have not yet been assigned.)

c. Assume that instead a minimal cost, you wanted a maximal total cost. Describe how you could obtain the maximal total cost using Munkres' Assignment algorithm. (You do not have to implement this.)

d. How many different assignments of the ten jobs to ten workers is possible.

e. If the *Polisher* was no longer needed who would be laid off? (Based on maintaining a minimal cost of manufacturing.)