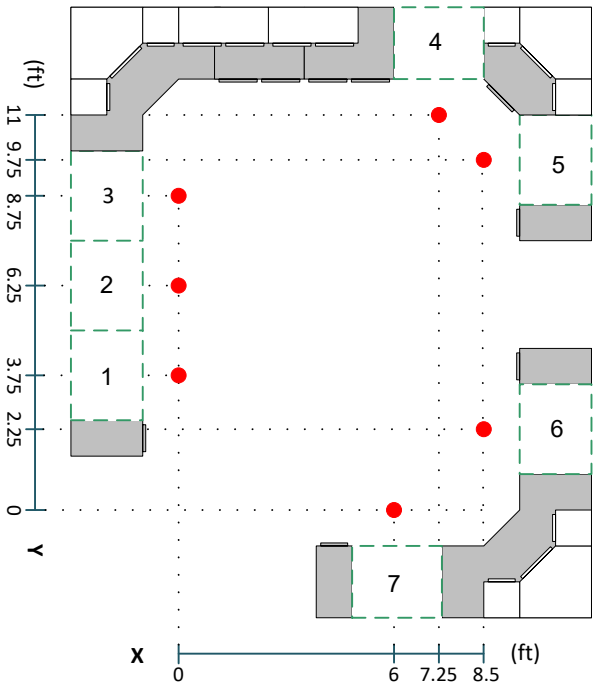
ICA 16: Kitchen Layout

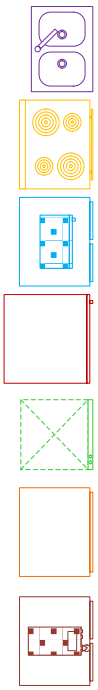
ISE 453: Design of PLS Systems — Spring 2020

This ICA does not contain need to be any questions that need to be submitted in Moodle. Determining a layout for the kitchen shown below corresponds to assigning each of the seven different Appliances to one of the Sites in the kitchen. The dots in front of each Site location correspond to the location in the kitchen at which a person would stand when using the Appliance. Table 1 shows the Euclidean distances between all pairs of Sites, and Table 2 shows the distance from the point at which a person enters the kitchen. Table 3 shows the sequence of appliances that are visited while preparing an estimated number of the meals per week.

Site Locations



Appliances



1	T/K	Trash/Sink
2	S	Stove
3	M	Microwave
4	R	Refrigerator
5	W/D	Worksurface/ Dishwasher
6	P	Pantry
7	C	Cupboard/ Coffeemaker

Table 1. Site-to-Site Distances

Site	1	2	3	4	5	6	7
1	0.0	2.5	5.0	10.3	10.4	8.6	7.1
2	2.5	0.0	2.5	8.7	9.2	9.4	8.7
3	5.0	2.5	0.0	7.6	8.6	10.7	10.6
4	10.3	8.7	7.6	0.0	1.8	8.8	11.1
5	10.4	9.2	8.6	1.8	0.0	7.5	10.1
6	8.6	9.4	10.7	8.8	7.5	0.0	3.4
7	7.1	8.7	10.6	11.1	10.1	3.4	0.0

Table 2. Distance from Location (0,0) to Sites

Site	1	2	3	4	5	6	7
(0,0)	3.8	6.3	8.8	13.2	12.9	8.8	6.0

Table 3. Meals Prepared During Each Week

Meal	Freq.	Sequence
Snack	25	R–M (4–3)
Drink	10	C–R–W–T (7–4–5–1)
Breakfast	7	C–T–C–R–C–K (7–1–7–4–7–1)
Lunch	2	R–W–M–W–R–S–T (4–5–3–5–4–2–1)
Dinner	6	P–W–R–K-W-S-M-W-T (6–5–4–1–5–2–3–5–1)
Cleanup	8	K–D–K–R–K–D (1–5–1–4–1–5)

Questions

1. What criterion (or criteria) would you use to compare different kitchen layouts? How would you justify your criterion relative to other criteria?
2. To consider all of the meals in the design of the layout, create a "From/To matrix" that combines all of the sequences of Appliance visits for all of the meals:

From\To	1	2	3	4	5	6	7
1	—						
2		—					
3			—				
4				—			
5					—		
6						—	
7							—

3. Without considering entering or leaving, determine the "best" kitchen layout for all of the meals by assigning each Appliances 1–7 to one of the Sites 1–7:

Site	1	2	3	4	5	6	7	
Appliance								

4. Determine the best kitchen layout using multiple runs (at least 10) of Excel function `sdpi`.
5. Use the Excel function `dijk` to determine a 10 × 10 distance matrix for the 10 site locations shown on the figure below. Indicated on the figure the distances of each of the 24 arcs in the figure (compared to $10(9)/2 = 45$ arcs between all 10 site nodes).