Project 2: Facility Layout

ISE 453: Design of PLS Systems **Spring 2020**

Assigned: Apr, 7 Nov (Individual) Due: 11:30p, Tue, 21 Apr

This is an individual project. Problems 3 and 4 require the use of the SDPI Machine Layout spreadsheet, the link to which is provided in number 16 on the course homepage. There is also a link to the SDPI Excel Handout, which contains information on how to use the macros for the layout problems needed for this project. If you have any problems running the macros, using, for example, a Mac, then you may be able to run it if you can find a PC to run Excel. If not, then the Virtual Computing Lab may be an option. Problems 1 and 2 can be done by hand, and you can just scan and submit your answers. Problems 3 is solved using a heuristic procedure that may give different results depending on your starting layout. Your answer for Problem 4 will depend on how you locate intersection nodes in your network and how you estimate distances. The distances can be estimated fairly roughly, as long as you indicate the values on your network. You can scan your network, indicating the intersection nodes and the distances of each arc. If you look closely at the figure for Problem 4, distance dimensions are included along each wall segment in the figure. You can use the scale to estimate the distances of your arcs.

1. (10 pts) Products A, B, and C are to be produced using three different machines, Machines 1–3. The routings for the products are A: 1–2–3–1–3, B: 2–1–3–1, and C: 3–1–2. The material handling effort for each unit of each product is expected to be inversely proportional to the number of units that can be placed on a pallet. Two units of Product A, one unit of Product B, and four units of Product C can be placed on a pallet. Assuming there is no scrap and that 64, 44, and 80 units of A, B, and C, respectively, are to be produced, determine equivalent flow volumes between the machines.

2. (12 pts) Each node $\mathbf{a}_1$ to $\mathbf{a}_{24}$ of the pairwise interchange graph shown in Figure 5.6 on p. 95 of the Lecture Notes represents one of the 4! = 24 possible machine-to-site assignment vectors for a 4-machine–4-site machine layout problem. The nodes of the graph are labeled with the total cost of material flow associated with each assignment. Use the SDPI heuristic to determine a (locally) optimal layout for each of the following three different initial assignment vectors (please list the intermediate nodes used at each iteration):

   (a) $\mathbf{a} = \mathbf{a}_1$

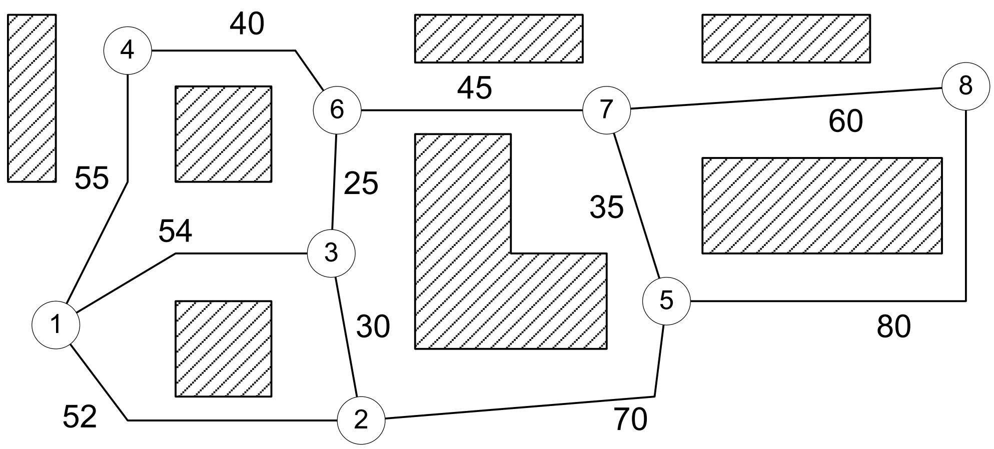
   (b) $\mathbf{a} = \mathbf{a}_{17}$

   (c) $\mathbf{a} = \mathbf{a}_{23}$.

3. Products A, B, C, D, E, and F are to be produced using eight different machines, Machines 1–8. The products will be transported between the machines using totes; thus, the handling effort of each product is expected to be proportional to its volume. The routings are as follows:

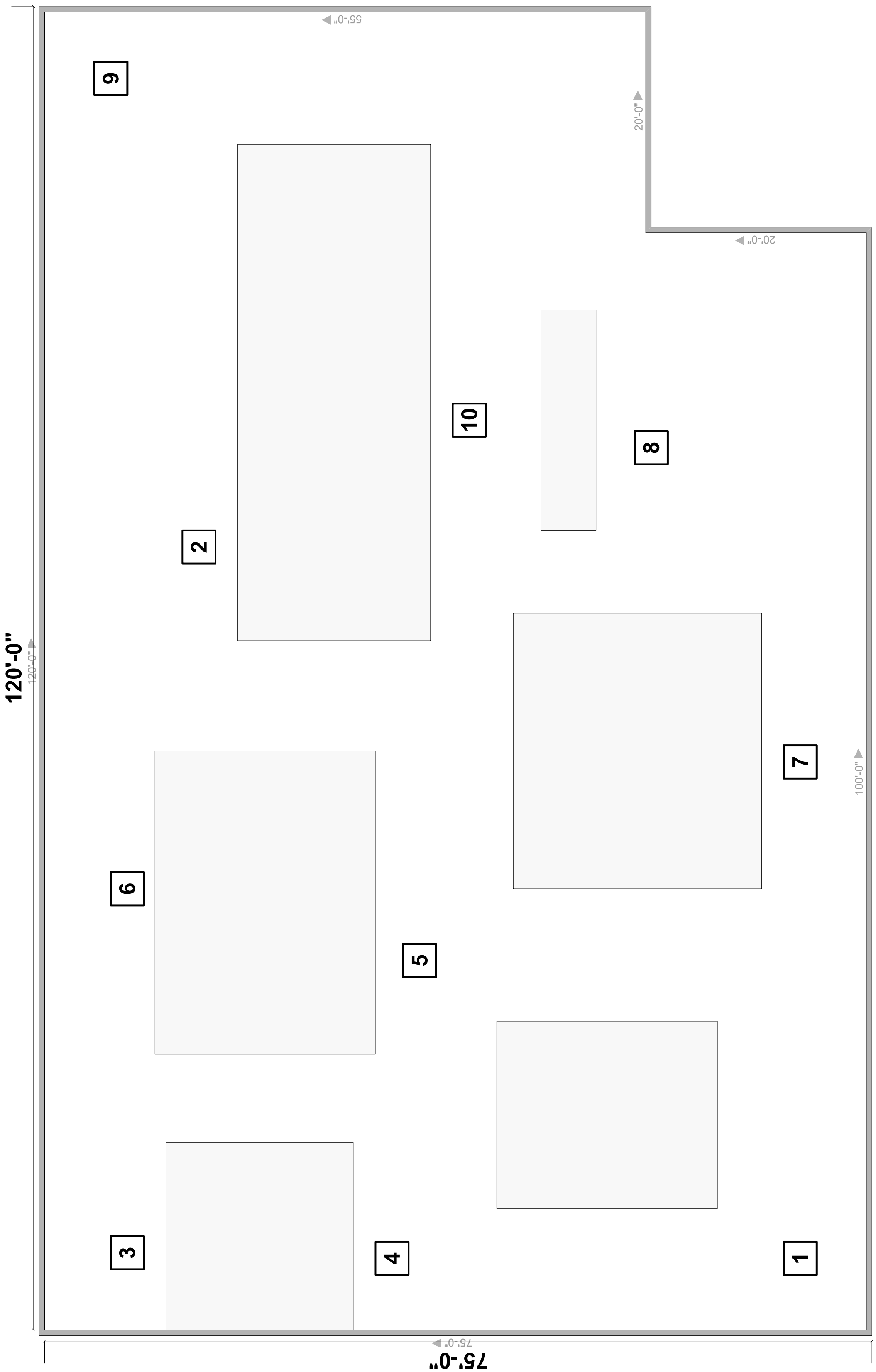
A: 3–6–5–8–6–4	C: 8–4–2–6–5–3–1–7	E: 5–8–2–6–5–3–1–7
B: 5–3–4–1–7–5	D: 6–1–4–7–3–5–8–2	F: 7–6–4–6–4

Assuming there is no scrap, that 242, 472, 351, 82, 118, and 735 units of A, B, C, D, E, and F, respectively, are to be produced, and that the dimensions of each unit of A, B, C, D, E, and F is $4 \times 2 \times 1$, $12 \times 8 \times 5$, $6 \times 3 \times 4$, $8 \times 3 \times 4$, $15 \times 5 \times 3$, and $15 \times 10 \times 4$, respectively, determine a machine layout using the Excel function sdpi that minimizes the total cost for the following site locations:



You can indicate (by drawing a square) the site each machine is assigned to in the best layout found from multiple runs (at least 10) of `sdpi`.

4. (40 pts) Use the Excel function `dijk` to determine a 10×10 distance matrix for the 10 site locations shown in the figure below. Indicate and label on the figure all of intersection nodes that you added to the figure (the first intersection node added is Node 11, etc.) and the distance of each arc.


120'-0"
75'-0"
55'-0"
20'-0"
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