Systematic Layout Planning Procedure (SLP):

* You are given flows and departments dimentions with building dimention. 600 horizontal x 1000 vertical.

Step ①: From-to chart in one direction (الجمع)

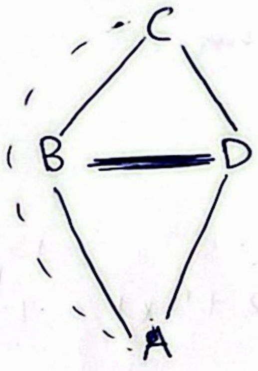
	A	B	C	D
A	–	375	125	365
B		–	400	620
C			–	400
D				–

Step ②: Activity Relationship chart (رتبي الأهمية حسب الأرقام)

620 → A
400, 400 → E
375, 365 → I
125 → O

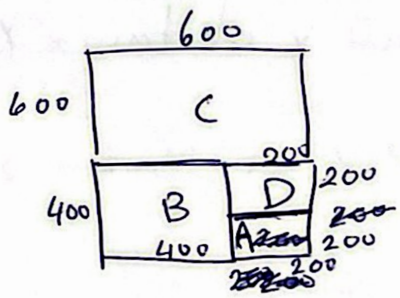
	A	B	C	D
A	–	I	O	I
B		–	E	A
C			–	E
D				–

Step ③: Relationship diagram (رسمة سريعة مع خطوط)



او بالعرض

step ④: Space Relationship diagra



خدي بعين الاعتبار الابعاد بالرسم.

600 x 1000.

Pair Wise : improving sequence.

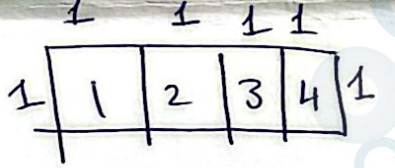
* You are given original sequence, and are asked to improve ~~cost~~ flow, and dimentions for distance

step ① : from-to chart in one direction.

~~tip : it is easier to name alphabets as numbers.~~

	1	2	3	4
1	-	10	15	20
2		-	10	5
3			-	5
4				-

step ② : Draw the sequence with dimentions.



step ③ : Find TC for this iteration and its alterations.

tip : keep flow sequence as is when solving.

TC = flow x distance x cost/unit

look here

TC 1234 = 10 x1 + 15x2 + 20x3 + 10 x1 + 5x2 + 5 x1 = 125 (is there less?!)

look here

TC 2134

TC 4231

TC 1432

TC 3214

TC 1324

TC 1243

Improve

Step (4): Take best solution and carry on until no ~~solution~~ better solution can be found.

3	2	1	4

= 9s

TC 3124

TC 3241

TC 3412

TC 1234

TC 2314

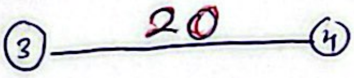
TC 4213

Graph Based Method :

* You are given relationship chart or relationship diagram. You'll use their numbers to find max sum of arcs.

Step ① : Select the two departments with largest weight on top

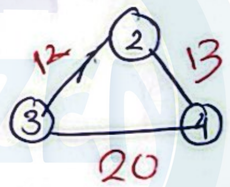
	3	4	sum
1	8	10	18
2	12	13	25
5	0	2	2



2 (25) → تفوز بوصل لل top

↳ 3,4 20 علاقتهم

Step ② : Draw the department that is تفوز close to both of them

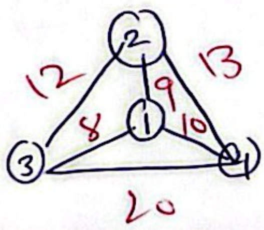


Step ③ : see who has largest sum of weight to get to the top

	2	3	4	sum
1	9	8	10	27
5	7	0	2	9

1 (27) → تفوز

step ④ : draw it in the ~~midde~~ middle.



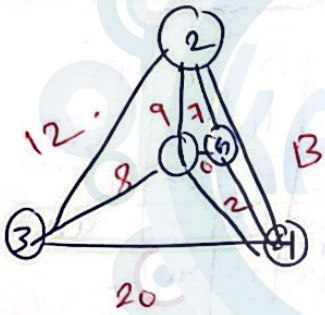
Step ⑤ : continue seeing who can get to the top, but with faces.

	3 4	2 1	sum.
5	0	0	7

Faces	
1-2-3	7
1-2-4	9
1-3-4	9
2-3-4	2

best faces

Step ⑥ : draw in faces.



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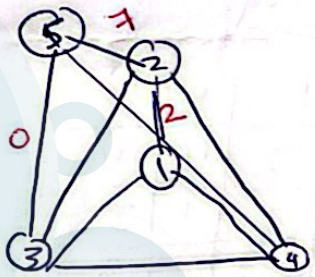


Layout Evaluation Algorithms:

[1] Minimize total cost / flow / load

Distance based scoring.

$$\min \quad z = \sum_{i=1}^{m} \sum_{j=1}^{m'} f_{ij} c_{ij} d_{ij}$$

d_{ij} = between centroids.

distance data: $|x_i - x_j| + |y_i - y_j|$

make it as table:

Flow data

	A	B	C	D
A	-	2	4	4
B	1	-	1	3
C	2	1	=	2
D	4	1	0	-

Distance data.

	A	B	C	D
A	-	40	20	55
B	40	-	65	25
C	25	65	-	40
D	55	25	40	-

cost data.

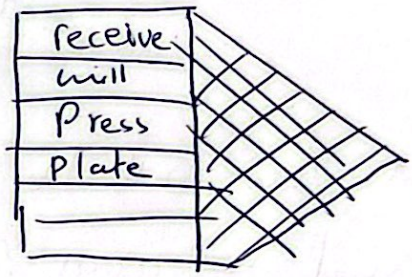
	A	B	C	D	sum
A	-	80	100	220	400
B	40	-	65	75	180
C	50	65	-	80	195
D	220	25	0	-	245
					1020.

Maximize total relationship, ~~score~~ score.

Adjacency scoring:

$$\max z = \sum_{i=1}^{m-1} \sum_{i+1}^{m} f_{ij} x_{ij}$$

x_{ij} < 1 share border
0 dont share a border.



* You are given relationship chart and a layout for the facility.
and weights of A, E, I, O, U

step (1): number the departments.

receive 1, mill 2, press 3, plate 4.

step (2): relationship table only for things that you see are adjacent in the layout given.

	1	2	3	4	5	6	7
1				4 I	O		
2				16 E	4 I		
3							
4							
5							
6							

= 4 + 1 = 5

= 16 + 4 = 20

total score = 25.

Efficiency rating:

$$E = \frac{\sum_{F^+} f_{ij} x_{ij} - \sum_{F^-} f_{ij}(1 - x_{ij})}{\sum_{F^+} f_{ij} - \sum_{F^-} f_{ij}}$$

* You will be given a mini layout to know borders and a from to chart.

Step ①: Find the ~~b~~, positive and negative adjacent scores.

$\sum f_{ij} x_{ij}$ = flow x shares a border or not + flow x // + ...

only for positives in ~~flow~~ from-to chart.

$\sum f_{ij}(1 - x_{ij})$ = flow x (1 - shares a border or not) + flow x // + ...

only for negatives in from-to chart.

step ②: find ~~flow~~, ~~sum~~ sum of flows of positives, ~~and~~ negatives

$\sum f_{ij}$ = sum of positive flows.

$\sum_{F^-} f_{ij}$ = sum of negative flows.

step ③: حوض بالعادي

CRAFT:

① Find centroids of all departments.

② Calculate distances between all centroids.

③ Calculate TC (transportation cost) which equals

$TC = \Sigma F_{ij}\, d_{ij}\, c_{ij}$ for all departments.

Sum them up and this is the initial total cost.

④ Exchanging: sharing border or same area.

1- When exchanging, centroids do not change but only places change. (stay as before at the same location)

2- distances will change so recalculate them.

3- TC will change " " "

⑤ Keep exchanging until you find least cost exchange.

⑥ After finding least cost, we calculate real centroids (actual) after exchange to find real cost (actual)

How? ↓

- If the areas were the same, the centroids and cost stay the same.

- If the area's were different (sharing a border):

1- Focus on both departments only, and draw each one in place of the other even if the shape differs when exchanged.

2- x, y coordinates will change, area will change, if the "new shape" has irregular shape, divide it to regular shapes in order to find area and centroids for divided shape.

	Area	x	y	Ax	Ay
A_1					
A_2					

3- if the shape was divided then centroid for the whole shape is: $x_c = \frac{\Sigma Ax}{A}$ * $y_c = \frac{\Sigma Ay}{A}$

4- final real cost, is it really less?