List 1 report

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Exercise 1

Results:

	MST weight
XQF131	474
XQG237	897
PMA343	1179
PKA379	1151
BCL380	1444
PBL395	1124
PBK411	1180
PBN423	1201
PBM436	1269
XQL662	2240

QA:

Why weight of MST must be smaller than optimal cycle of salesman?

If it wasn't smaller, you could take that cycle, remove any edge and in result you will get MST that is smaller, contradiction.

Exercise 2

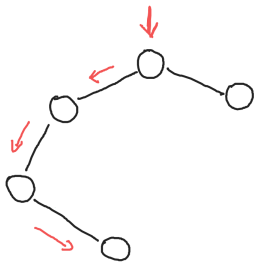
Results:

	MST Cycle weight
XQF131	758
XQG237	1456
PMA343	1861
PKA379	1838
BCL380	2341
PBL395	1819
PBK411	1870
PBN423	1944
PBM436	2053
XQL662	3650

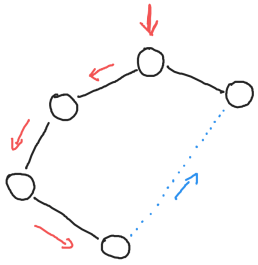
QA:

Why weight of cycle made out of MST shouldn't be bigger than weight of tree times 2?

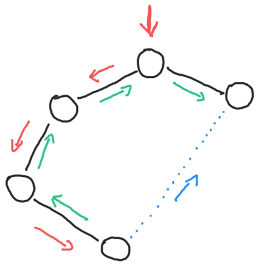
After visiting all vertexes in some branch in MST.



We will find ourself in situation where we need to use edge outside of MST.



But because cost function satisfies triangle inequality, we know that direct edge won't have bigger weight than path with aditional vertexes.



So blue edge isn't bigger than sum of green edges. Weight in worst case can only double.

Exercise 3

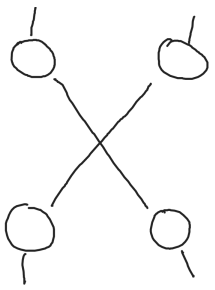
Results:

	avg from minimal in 10	afg from minimal in 50	minimal
XQF131	4337.13	4191.15	3930
XQG237	11904.44	11628.15	11250
PMA343	34371.73	33562.55	32485
PKA379	35393.47	34713.3	34009
BCL380	24739.64	24334	23942
PBL395	19178.66	18909.1	18580
PBK411	21627.48	21242.3	20497
PBN423	21935.77	21613	21296
PBM436	22469.14	22051.65	21528
XQL662	51143.69	50552.2	49802

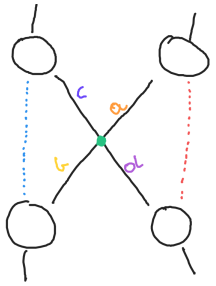
QA:

Does edges can cross in optimal salesman cycle?

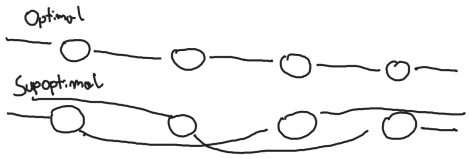
Assume that there is optimal salesman cycle that have edges that cross each other. Let's draw this crossroad that there is a path in cycle between top two without any bottoms vertexes and vice versa.



We can make virtual vertex on crossing, it will split edges into two parts.



As our cost function satisfies triangle inequality. Red direct edge won't have bigger weight than a + d, and Blue direct edge won't have bigger weight then b + c. However, in circumstances where they are equal, all vertexes will be on one line.



Optimal solution in this case wouldn't have any crossing and should be created by taking cheapes edges.

So in fact by splitting all crossings or taking cheapes edges in line circumstances we will create cycle that have smaller cost, contradiction.