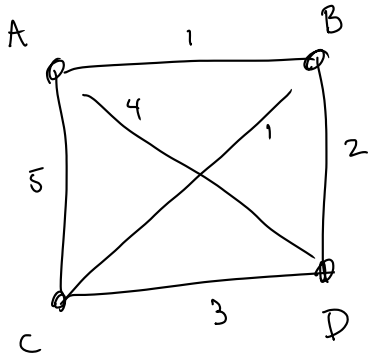


TSP



Find the Ham circ with minimal total weight.

Brute-force:

$$ABCD A : 1 + 1 + 3 + 4 = 9$$

$$ABDCA$$

⋮

choose the smallest.

Brute Force is too intensive to check,
even using a computer.

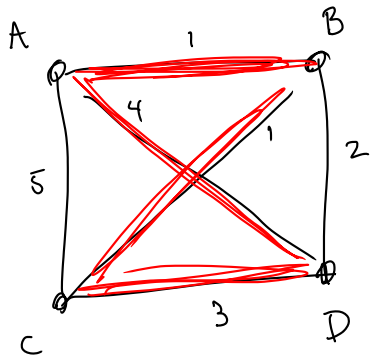
Practically speaking, we don't try to find
the best route, but one that's pretty good.

"Approximate" algorithms for TSP.

Nearest-Neighbor (NN)

Sorted Edges

Nearest Neighbor



Choose a starting point,
pick edges as you go, each
time use the cheapest edge
"the nearest neighbor"

Don't revisit any vertex until the end.



Starting at A: A to B (1)
 B to C (2)
 C to D (3)
 D to A (4)

Using NN starting at A is:

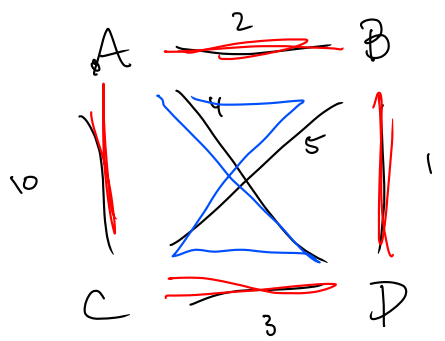
$$A \rightarrow B \rightarrow C \rightarrow D \rightarrow A : 1+2+3+4 = 9$$

NN is much faster than brute force!

Brute force requires $(N-1)!$ steps

NN requires N steps \leftarrow much less

Unfortunately, NN doesn't always choose
the best route:



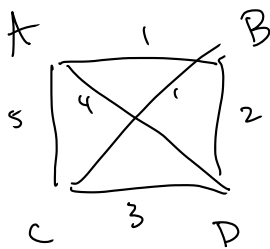
NN starting at A:

ABDCA is $2+1+3+10=16$

but ADCBA is $4+3+5+2=14$

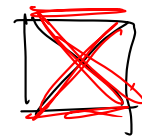
∴ NN did not choose the best route.

NN oddity: It matters where you start



Start at A:

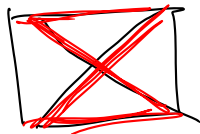
ABCD A → 9



Start at B

BCDAB → 9

(same)



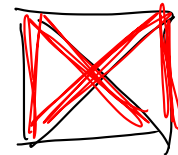
Start at C:

CBADC → 9



Start at D:

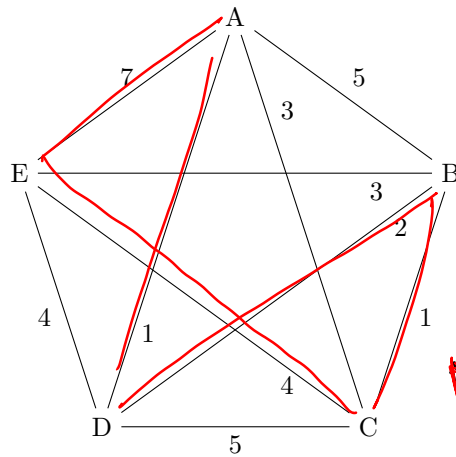
DBCAD → $2+1+5+4$
= 12



Different starting points may give different answers.

We can do the repeated NN

do NN repeatedly, starting
from all possible verts.
When we're done, choose the best
overall.



A:
ADBC EA
 1 2 1 4 7 → 15

B:
BCA DEB
 1 3 1 4 3 → 12



C: CBDAEC → 15

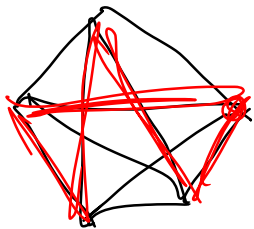
D: DACBED → 12

E: EBCADE → 12

"Use Repeated NN to find a good circuit starting at A" ← write your answer at A.

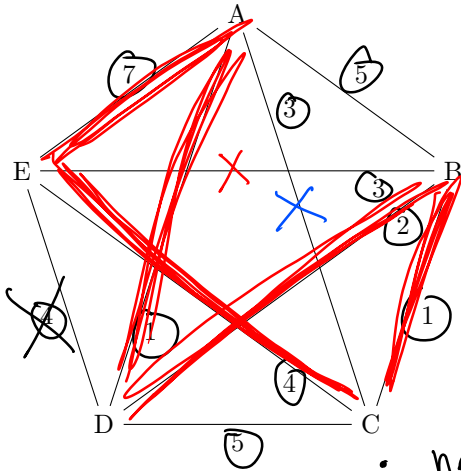
Do repeated NN, then write your best circuit as if it started at A.

BCA DEB → A DEBCA



The Sorted Edges Algorithm

Write out the edges in order
by weight



✓ ✓ ✓ ^{subcirc 3-way} ✓ ~~3~~ ✓ ~~4~~ ✓ ~~5~~ ✓ ~~6~~ ✓ ~~7~~ ✓

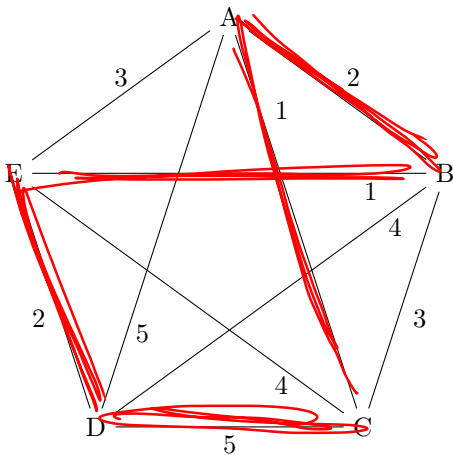
Choose these edges 1 by 1,
(don't try to connect them up)

- never make a subcircuit
- never make a 3-way junction.

Write your answer starting wherever you like

"starting at B": BC EADB

Use the sorted edges algorithm to find a good Hamilton circuit starting and ending at A:

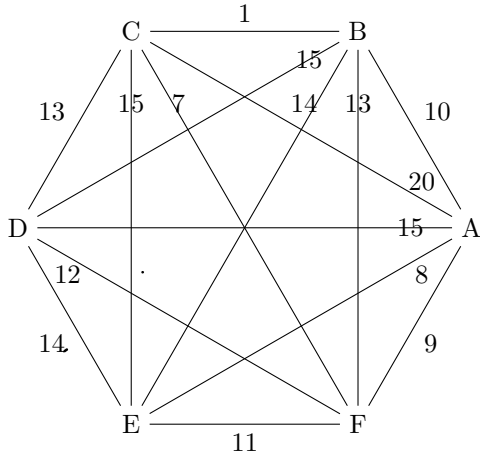


①, ①, ②, ②, ~~3~~, ~~3~~, ~~4~~, ~~4~~, 5, 5

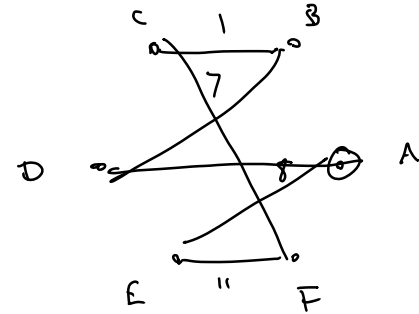
ABEDCA

ACDEBA

Find a good Hamilton circuit starting at A using the Nearest Neighbor algorithm, and the Sorted Edges algorithm.



NN:



AEFCBDA → 57

~~1, 7, 8, 9, 10, 11, 12, 13, 13, 14, 14, 15, 15, 15, 2~~

$$AFCBDEA : 9 + 7 + 1 + 15 + 14 + 8 = 54.$$

