



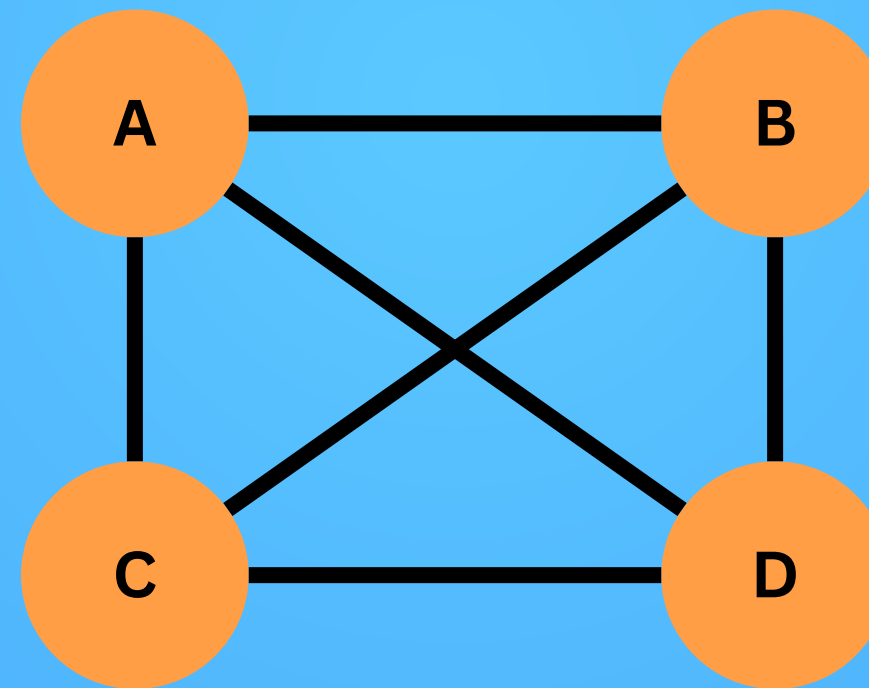
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EVOLUTIONARY ROUTES

ACTIVITY: GENETIC TRAVEL GUIDES

IDEA

Sometimes when picking routes between destinations, we can choose any order we like because all vertices are connected to each other.



ACTIVITY

Today we're going to use artificial genetics to find the shortest route.

STEP 1

Get into teams of 2-3 and write down on a piece of paper the letters **a**, **b**, **c**, **d**, and **e** in any order you like.



This sequence is your **chromosome**.

	a	b	c	d	e
a	0	12	7	8	9
b	12	0	6	19	3
c	7	6	0	4	11
d	8	19	4	0	13
e	9	3	11	13	0

STEP 2

Calculate the fitness of your chromosome.

If your chromosome was:

a c d b e

then its fitness score is:

$$7 + 4 + 19 + 3 = 33$$

PAUSE!

Who has the fittest chromosome?

Smaller fitness scores are better.



STEP 3

Find another team. You're going to **crossover** your chromosomes to make two new ones.

Pick a subsequence of two entries in their chromosome and make a crossover.

STEP 3: EXAMPLE

My chromosome is: **a c d e b**

Their chromosome is: **d b a c e**

I choose to take their first two entries: **d b**

I fill in the rest with my entries as they appear (left to right) in my chromosome: **d b a c e**

This is my new chromosome.

STEP 3: EXAMPLE

If you like, you may swap the order of two entries in your chromosome.

This is called a **mutation**.



	a	b	c	d	e
a	0	12	7	8	9
b	12	0	6	19	3
c	7	6	0	4	11
d	8	19	4	0	13
e	9	3	11	13	0

STEP 4

Calculate the fitness of your new chromosome.

If it has a smaller (better) fitness value, keep it!

PAUSE!

We now have a **new generation!**

Who has the fittest chromosome?

Smaller fitness scores are better.



CONTINUE

Repeat steps 3 and 4, five more times.

See if you can crossover to make the fittest chromosome.



EVOLUTIONARY ALGORITHMS

Your whole class just performed an **evolutionary algorithm**.

- 1) Start with an **initial population** of chromosomes.
- 2) Assess their **fitness scores**.
- 3) **Crossover** with other chromosomes to make new ones.
- 4) **Randomly mutate** the new chromosomes.
- 5) Start a new **generation**