Parents (permutations, length 7):

$$P_1 = [A\,B\,C\,D\,E\,F\,G], \qquad P_2 = [C\,F\,A\,G\,D\,B\,E]$$

Goal: build a valid child permutation that preserves **relative order** from P_2 while inheriting a **block** from P_1.
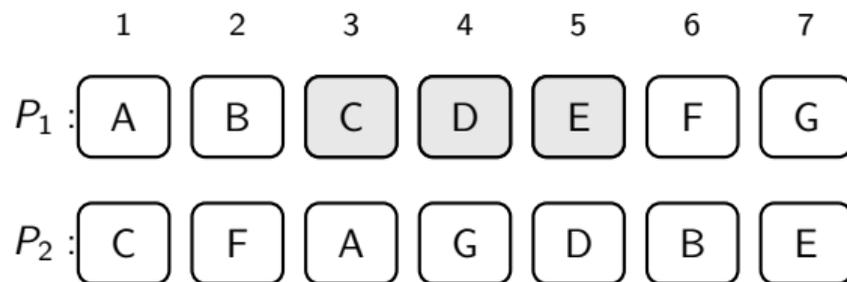
We will choose cut points at positions 3..5 and copy that block from P_1.

# OR/OX Step 1: Choose cut points and copy the block from P_1

Cut points: positions 3..5. Copy $P_1[3..5] = [C\,D\,E]$ into the child at the same positions.

Child:

Now the child has a fixed block; the remaining positions must be filled
using the relative order of cities as they appear in P_2 (skipping duplicates).

Rule: start scanning P_2 *after* the second cut point (after position 5), wrap around, and list cities not yet in the child.

P_2 : | C | F | A | G | D | B | E |

start scan after cut
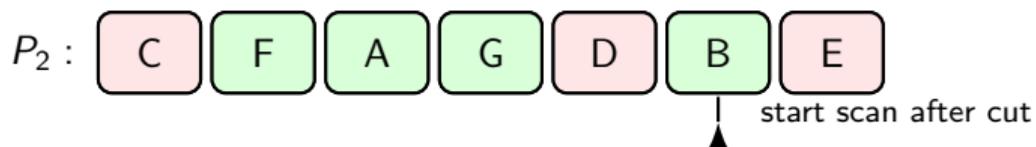
Fill list (scan order): $[B,\ F,\ A,\ G]$

Scan order: $B \rightarrow E \rightarrow C \rightarrow F \rightarrow A \rightarrow G \rightarrow D$

Skip $\{C, D, E\}$ (already copied). Keep the rest in that order.

Empty slots in the child: positions $1, 2, 6, 7$. **Insertion rule:** start filling *after* the second cut point (positions $6, 7, 1, 2$).

	1	2	3	4	5	6	7
Chil	A	G	C	D	E	B	F

Fill list: $[B, \ F, \ A, \ G]$

Insert after the cut: positions $6 \rightarrow 7 \rightarrow 1 \rightarrow 2$
So B goes to pos6, F to pos7, A to pos1, G to pos2.

OR/OX Result: Final Child and What Was Preserved

Final child

$$C_{OR/OX} = [A\ G\ C\ D\ E\ B\ F]$$

What was preserved?

▶ The block $[C\ D\ E]$ is copied **exactly** from P_1.

▶ The remaining genes $[B, F, A, G]$ appear in the child in the **same relative order** as in the cyclic scan of P_2.

Note

OR/OX preserves a contiguous block from one parent and the **relative order** from the other.

Child

| A | G | C | D | E | B | F |

Gray = copied block from P_1
Green = filled from P_2 order