

Problem(s) statement

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- Heat sensitive items will spoil if held in cart for a long time.

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- Going through a supermarket, if the path isn't chosen wisely, the trip will take **long time**.
- Heat sensitive items will **spoil** if held in cart for a long time.
- Price of products – Leave to politicians !



Two
objectives

Supermarket layout:

- Create a grid

	1	2	3	4	5
1					
2					
3					
4					
5					








Supermarket layout:

- Create a grid
- Define start and finish

	1	2	3	4	5
1					
2					
3					
4					
5					<div><div>חברים זה בא והולך, כסף זה לכל החיים!</div></div>


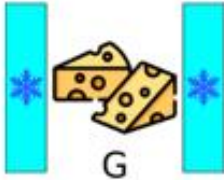

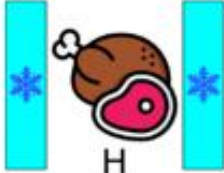
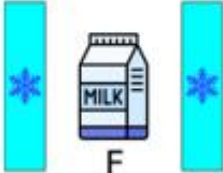
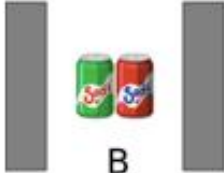


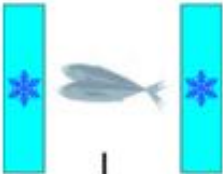


Supermarket layout:

- Create a grid
- Define start and finish
- Add regular isles

	1	2	3	4	5
1					
2		 C			
3			 B		 E
4					
5	 A		 D		


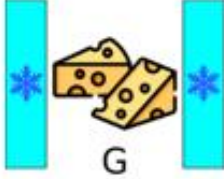



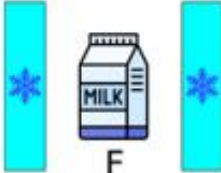





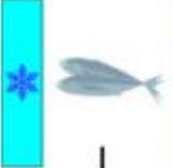


Supermarket layout:

- Create a grid
- Define start and finish
- Add regular isles
- Add cold isles

	1	2	3	4	5
1			 G		
2		 C		 H	
3	 F		 B		 E
4					
5	 A	 I	 D		

Supermarket layout:

- Create a grid
- Define start and finish
- Add regular isles
- Add cold isles
- Add penalty isles

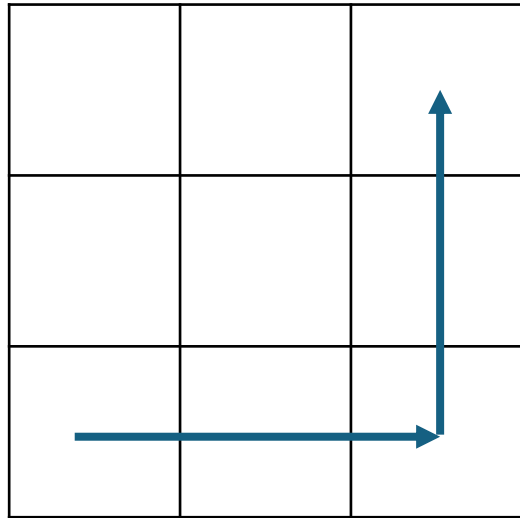
	1	2	3	4	5
1			 G		
2		 C		 H	
3	 F		 B		 E
4					
5	 A	 I	 D		

Assumptions

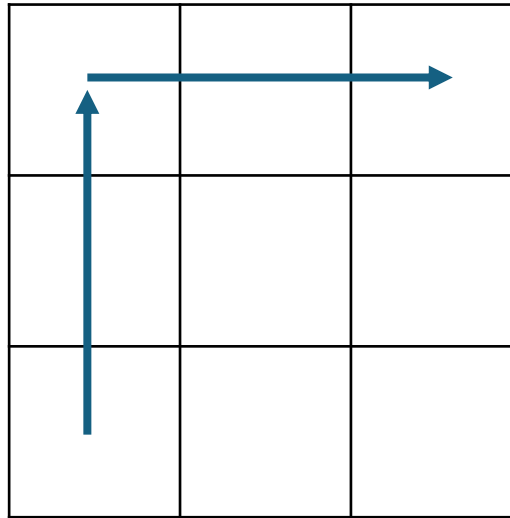
- Every shopper needs to visit all Isles before going to checkout.
- Every heat sensitive item (from cold isle) decays at same rate.
- Heat sensitive item starts decaying after getting picked up.
- Every shopper has a walking pattern.

Walking pattern

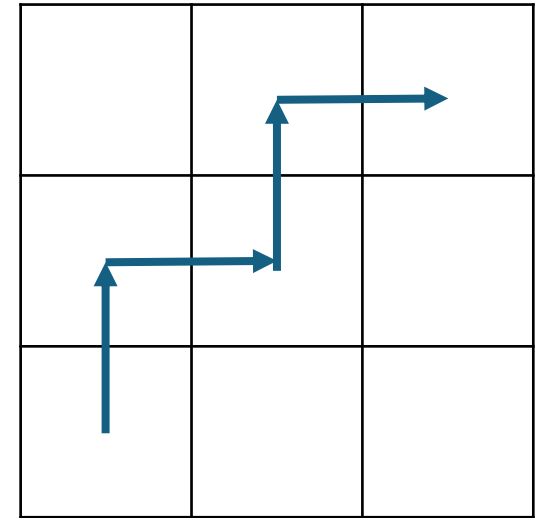
H2V: Horizontal To Vertical



V2H: Vertical then Horizontal



ZgZg: H,V,H,V,H...

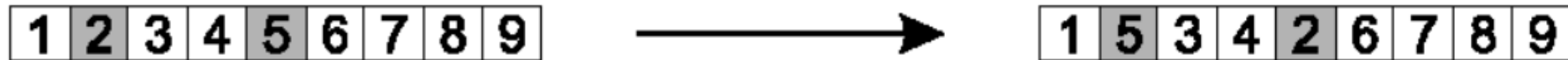


Challenges

- **Crossover and mutations** if done randomly (without rules) will almost always produce a faulty Individuals (like traveling salesperson problem).
- The **objectives are coupled**, if an individual scores high in one he will also score high in the other (and the opposite also), this is because both penalties time in similar proportion.
If we don't solve this challenge our problem will become a boring single objective problem.

Solving Crossover and Mutation challenge

- We use **Premutation Representation**(like TSP) , and the encoding is as follows: value of i^{th} element denotes position in sequence in which i^{th} event occurs, for example:
4 isles A,B,C,D and permutation [3,1, 2,4] denotes the order of visit is : [C→A→ B→ D].
- For Mutation, we use **Swap Mutation**
Choose two random element positions and swap the elements.



- For Crossover, we use **Order Crossover**
Select random segment from parent1, fill out the rest from parent2 (skipping elements copied from parent1)



Individual

Walking pattern	Isle visiting order				
V2H	H	D	C	A	...



V2H or H2V or ZgZg

Needs to include all isles

Solving Coupled Objective challenge

- To uncouple the objectives, we need a way to either penalize or reward only one of the objectives score.
- I used the “maintenance isle” to act as an isle that when stepped on will penalize only the decay (heat sensitivity) score, to act as a “Hot” isle.
- We can see the effect of the penalty on the coupling, the higher the penalty the less connected the two objectives become.

