



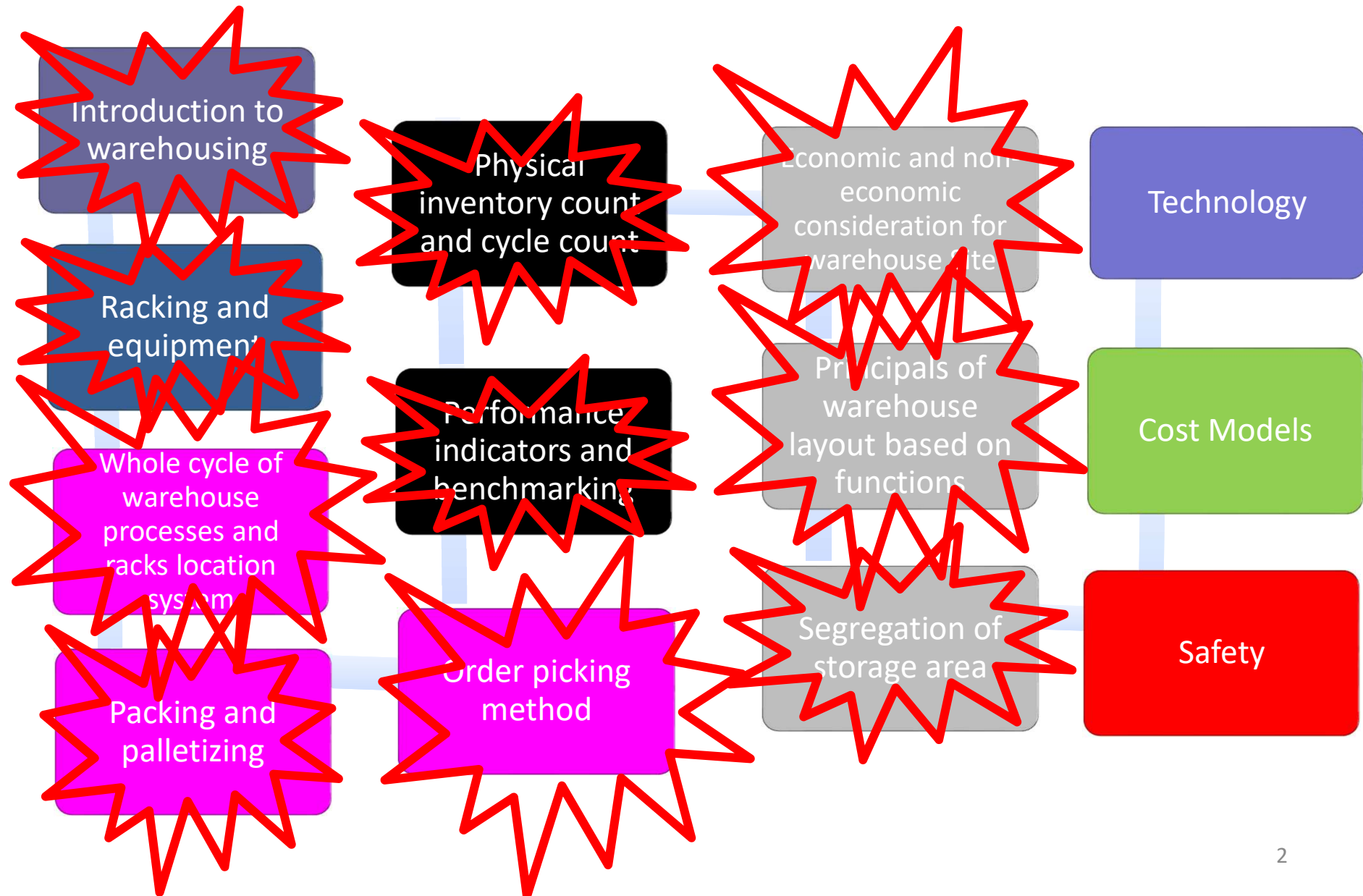
# Problem 10

## Strategic Goods Placement

SCHOOL OF  
ENGINEERING

E215 –  
Warehousing and  
Storage

# E215 Warehousing and Storage Topic Flow



# Learning Objective

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- Understand and explain the various factors affecting storage method selection:
  - Popularity
    - ABC Analysis
    - Receiving/Shipping ratio
  - Similarity
  - Size
  - Material Characteristics
  - Space utilization

# Storage Layout Planning

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- Objectives:
  - To utilize space efficiently
  - To allow the most efficient material handling
  - To provide the most economical storage in terms of:
    - Cost of machine
    - Damage to material
    - Handling labor
    - Operational safety
  - To provide maximum flexibility to meet changes.

# Principle Considerations for Storage Layouts

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- Popularity
- Similarity
- Size
- Material Characteristics
- Space utilization

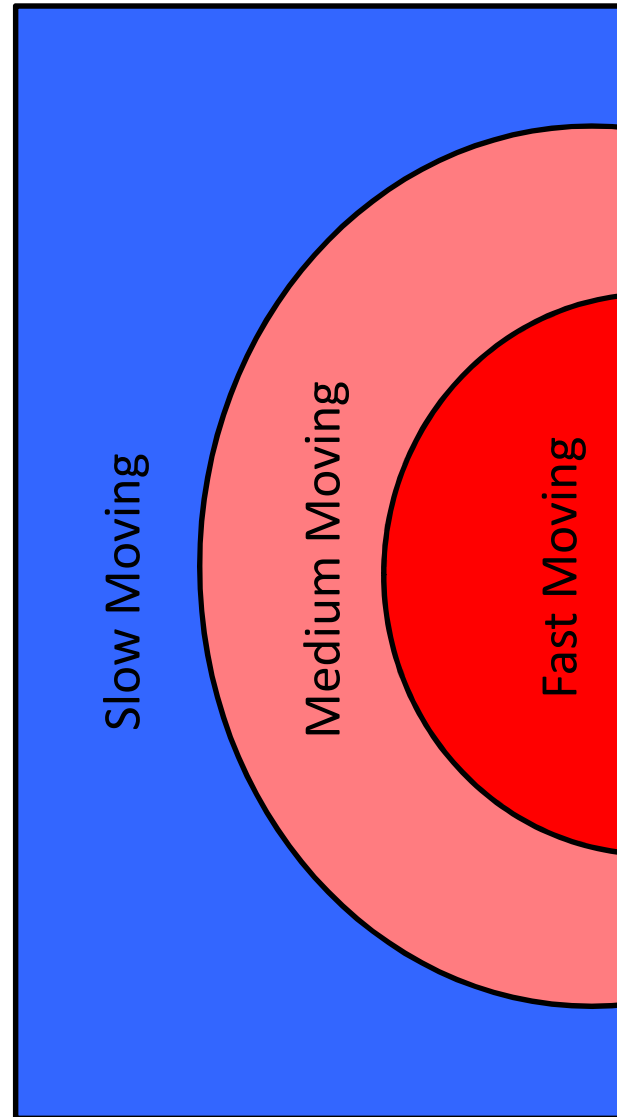
# Popularity

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- Using ABC classification or Pareto's law to determine the popularity of the goods.
  - Pareto's Law: 80/20 rule
  - 80% of the movement are caused by 20% of the goods.
  - In order to maximize the throughput, the popular 20% of the goods should be stored at locations where they have the least travelling distances.
  - Items with high movement should be near the entrance/exit of the warehouse
  - This method is good if the goods enter and exit the storage area at the same point. (See diagram on the next slide)

# Popularity



Entrance and  
Exit

# Popularity

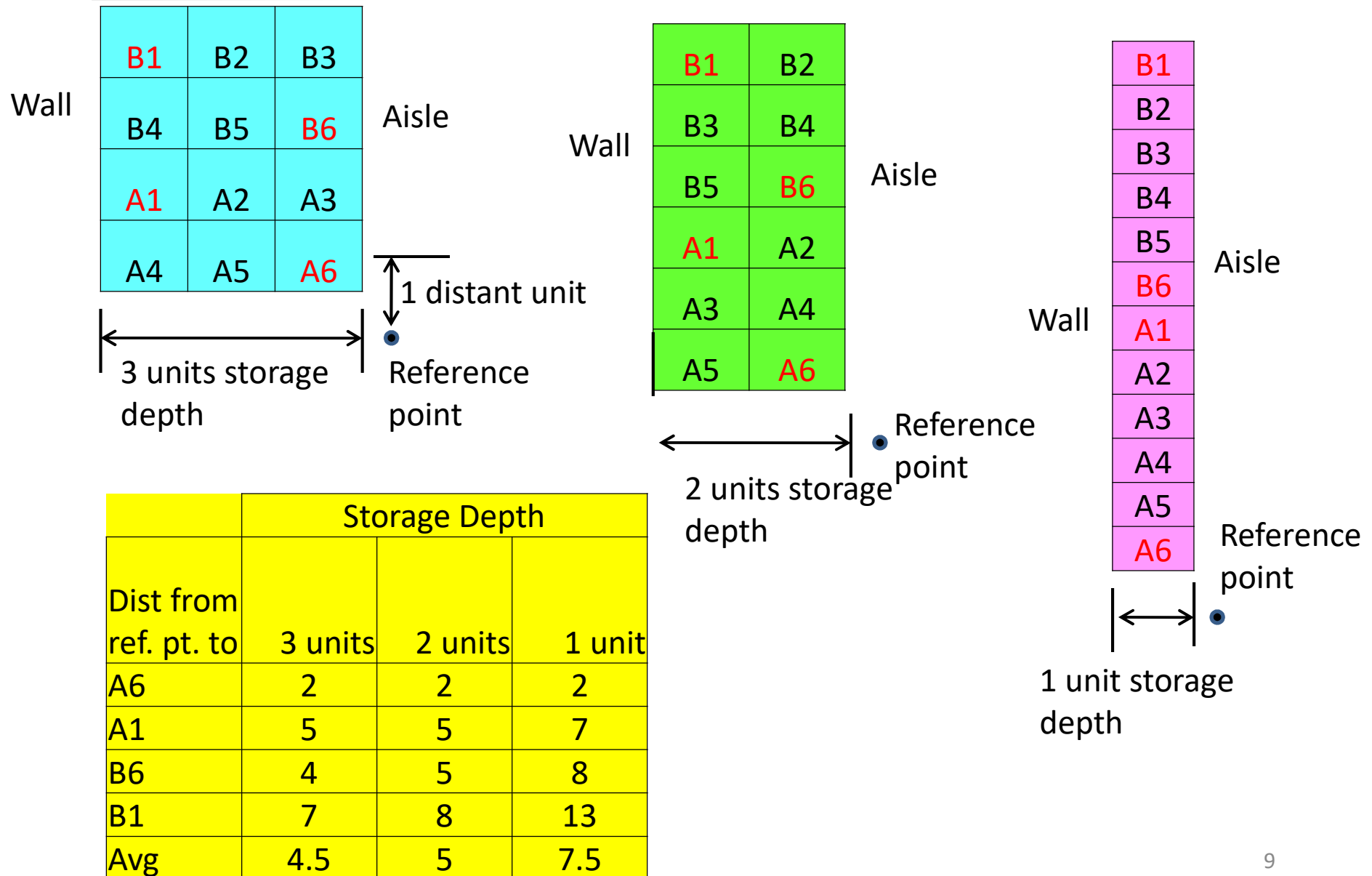
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- Storage depth also have an impact on distances travelled.
- Storing popular items in deep storage area may reduce the distance travelled.
  - See next slide for illustration.



# Popularity



# Popularity

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- If material enters and exits at different points, a different method will have to be used.
- This method uses the volume ratio of the receiving and shipping.
  - Number of trips are usually used to represent volume
  - E.g. the receiving volume for item A is 50 trips to the storage area.

# Popularity

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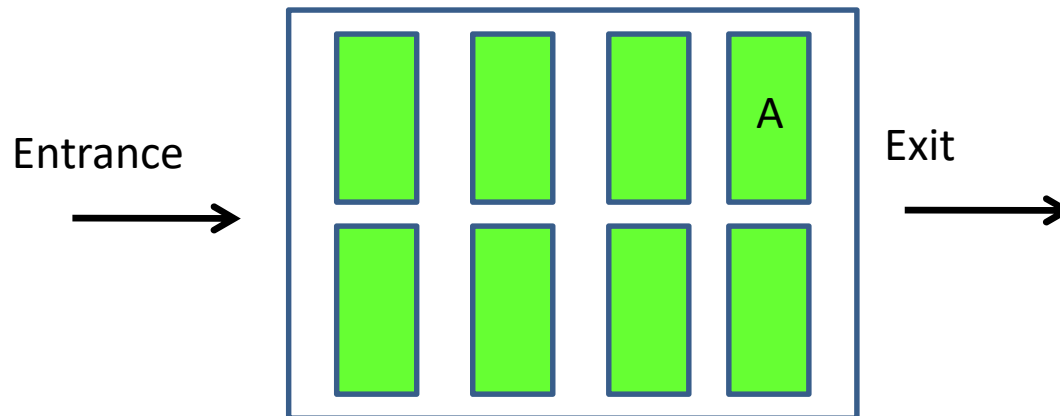


- Items with the smallest **receiving/shipping ratio** will be placed closest to the exit.
- If ratio is high, it should be near the entrance.
- If the ratio is 1, no matter where the item is placed, the travelling distance will be the same along the main aisle.

# Popularity



- Example
  - Item A arrives on average 40 pallets daily. The staff only can bring 1 pallet per trip from the receiving dock to the storage area. Average customer order is 0.5 pallets. Total daily shipping volume is 40 pallets.
  - The receiving/shipping ratio in this case is  $40/80 = 0.5$ .
  - This item should be placed near the exit.



# Similarity

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- Items that are received and/or shipped together should be stored together. E.g.
  - Items from the same vendor
  - Items that are related to each other
- This will help reduce travel distances when picking or putting away the items.
- Items that require the same kind of storage and handling methods can also be stored together as this will result in a more efficient use of space and MHEs.

# Size



- Heavy, bulky, odd size, hard-to-handle goods cost more in terms of handling, thus they should be placed near the entrance/exit for easy handling.
  - Reduce travel distance
  - Reduce handling time
  - Reduce handling cost



# Size



- Warehouse with different ceiling heights at different sections.
  - Heavy, bulky goods should be placed at section with low ceiling. Light, easy to handle goods should be placed at sections with high ceiling.
  - Because heavy goods may not be able to be stacked very high due to floor loading capacity, and stackability of the item.



# Size



- Storage size should be the size of the goods. This will ensure that space are not wasted.
  - Do not store a unit load of  $1\text{m}^3$  in a unit space of  $5\text{m}^3$ .





# Material Characteristics

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- Characteristics of material will impact how they can and should be stored. This may be in the contrary to the methods indicated by their popularity, similarity and size. Some important characteristics are as follows:
  - Perishable materials
    - Usually will require controlled environment. Shelf life must also be considered.
  - Oddly shaped and crushable items
    - Oddly shaped items may have difficulty going in a storage area thus open space may be needed.
    - Unit load size of crushable items may have to be adjusted and stacking may not be allowed

# Material Characteristics

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- Hazardous materials
  - These materials requires special storage and must conform to the local safety rules and regulations.
  - E.g. Paint, varnish, propane and other flammable and corrosive materials.
- Security items
  - These are items with high unit value and should be kept under lock and key.
  - These movement of these items must be traceable to prevent incorrect withdrawal and pilferage.
- Compatibility
  - Some chemicals are not dangerous when they are stored alone but become very dangerous when come in contact with other chemicals.
  - Some items do not require special storage but are easily contaminated if they come in contact with certain material.
  - Thus, when designing a storage plan, materials compatibility must be considered.

# Space Utilization

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- A good layout is one that maximize the space utilization and at the same time consider the popularity, similarity, size and characteristics of the materials that are being stored. Some factors to consider while developing a layout are as follows:
  - Space conservation
    - This means maximizing the concentration and cube utilization, and minimizing honeycombing.
  - Orderliness
    - Warehouse should be kept neat and tidy. A messy warehouse will increase item searching and also travelling time if the aisles are blocked by materials.
    - Aisles should be well marked with tapes or paint. This will mark out the aisles clearly and prevent materials from infringing into the aisle space.

# Space Utilization

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- Space limitations
  - Usable space are limited by posts, ceiling height, floor loading capacity, safe stacking height of materials, etc.
  - Materials can be stored compactly around posts and columns to maximized the space availability.
  - Knowing and understanding this limitation will help in designing a layout that will maximized the available space.
- Accessibility
  - Overemphasis on space utilization may result in poor material accessibility. Thus there must be a balance between space utilization and accessibility.
  - Examples:
    - Main aisles should be straight and lead to doors in order to improve maneuverability and reduce travel time.
    - Aisles should be width enough for MHE to maneuver.

# Suggested Solution

# Suggested Solution

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- Using the data provided, we will be using popularity as the factor for the arrangement of goods in the warehouses.
- From the worksheet,
  - Warehouse A has the entrance and exit on the same side.
  - Warehouse B has the entrance and exit on opposite sides.

# Suggested Solution



- Warehouse A
  - Items with the most movement should be placed near the entrance/exit.

SKU	Avg Daily Inbound Volume (Pallet)	Trips to storage	Avg Daily outbound Volume (Pallet)	Average customer order size (Pallet)	Trips to shipment	Total Number of trips	Total Number of sections needed
A109	38	38	38	0.2	190	228	4
A112	55	55	55	0.5	110	165	6
A116	25	25	25	0.2	125	150	3
A117	44	44	44	0.5	88	132	5
A113	45	45	45	1	45	90	5
A104	40	40	40	2	40	80	4
A118	21	21	21	0.5	42	63	3
A106	33	33	33	1	33	66	4
A105	30	30	30	3	30	60	3
A103	30	30	30	1	30	60	3
A102	28	28	28	2	28	56	3
A111	28	28	28	1	28	56	3
A114	25	25	25	2	25	50	3
A101	24	24	24	1	24	48	3
A107	22	22	22	1	22	44	3
A108	12	12	12	1	12	24	2

# Suggested Solution



- With no space consideration

Warehouse A

Receiving /  
Shipping

	A117	A118	A102	A107
	A109	A113	A105	A114
	A112	A104	A103	A101
	A116	A106	A111	A108



# Suggested Solution



- With space consideration (1 month inventory)

## Warehouse A

Receiving / Shipping	A109	A109	A109	A109	A116	A116	A116		A108	A108
	A112	A112	A112	A112	A112	A112	A102	A102	A102	
	A117	A117	A117	A117	A117	A118	A118	A101	A101	A101
	A113	A113	A113	A113	A113		A111	A111	A111	
	A104	A104	A104	A104	A103	A103	A103	A114	A114	A114
	A105	A105	A105	A106	A106	A106	A106	A107	A107	A107

- In this case, A118 is sharing a pallet section with A101.
- Worst case (even after sharing) if slightly full capacity per rack, temporary store some products on the floor.

# Suggested Solution



## Warehouse B

- Use Receiving / Shipping ratio
- The bigger the ratio, the nearer it should be to the entrance

SKU	Avg Daily Inbound Volume (Pallet)	Trips to storage	Avg Daily Inbound Volume (Pallet)	Average customer order size (Pallet)	Trips to shipment	Receiving / Shipping Ratio	Total Number of pallets location needed
B101	15	15	15	0.2	75	0.20	2
B103	18	18	18	0.2	90	0.20	2
B102	38	38	38	0.2	190	0.20	4
B107	43	43	43	0.5	86	0.50	5
B109	33	33	33	0.5	66	0.50	4
B104	24	24	24	0.5	48	0.50	3
B105	56	56	56	0.5	112	0.50	6
B106	45	45	45	0.5	90	0.50	5
B111	27	27	27	1	27	1.00	3
B114	36	36	36	2	36	1.00	4
B118	20	20	20	1	20	1.00	2
B113	38	38	38	1	38	1.00	4
B110	29	29	29	1	29	1.00	3
B108	30	30	30	1	30	1.00	3
B112	48	48	48	1	48	1.00	5

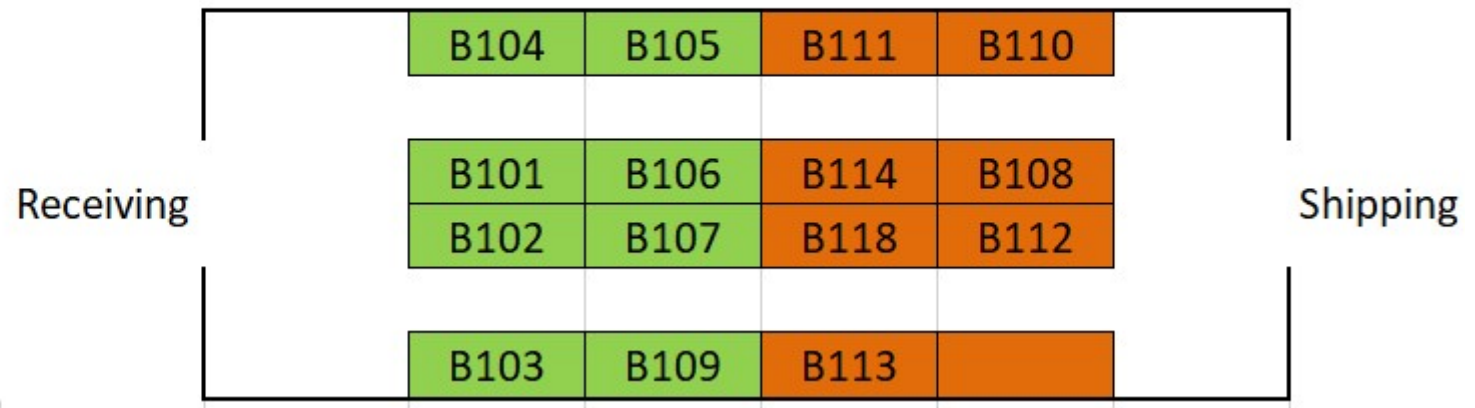
# Suggested Solution



With no space consideration

- Warehouse B

Warehouse B

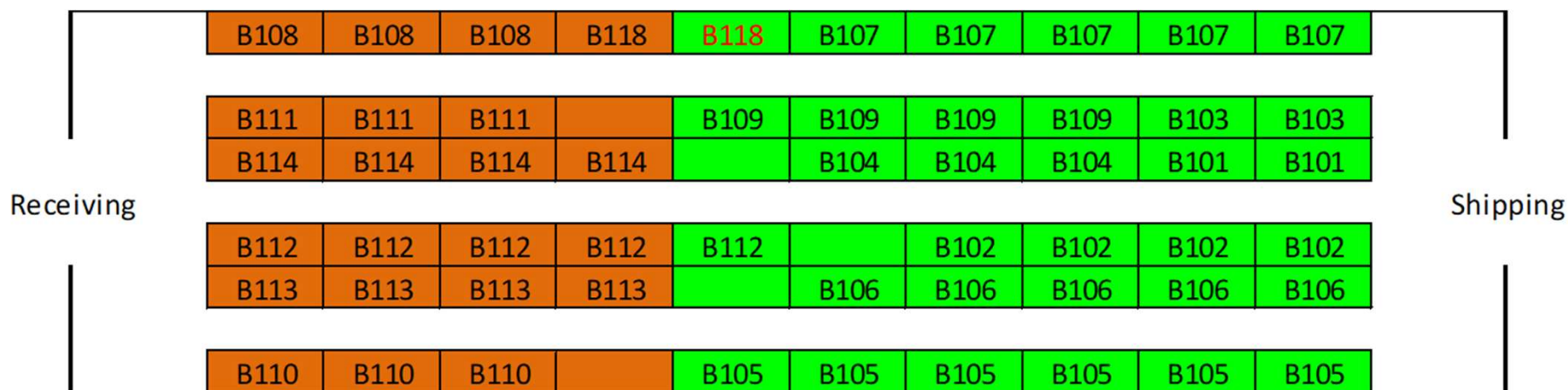


# Suggested Solution



With space consideration (1 month inventory)

- Warehouse B



- In this case, there are enough spaces on the racks.
- Worst case (even after sharing) if slightly full capacity per rack, temporary store some products on the floor.

Do you know the recommended  
storage utility?

80+%

# Learning Outcome

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- Understand and explain the various factors affecting storage method selection:
  - Popularity
    - ABC Analysis
    - Receiving/Shipping ratio
  - Similarity
  - Size
  - Material Characteristics
  - Space utilization