



# Bill of Materials Calculations using Matrices

## Student Activity Sheet

IBM Systems plan, design, test, manufacture and deliver some of the most advanced computing systems in the world. IBM products have complex structures requiring various sub-assemblies to manufacture our servers. In this example, you will leverage matrices to determine the required number of subassemblies required to build the Hydra Rack. The Hydra Rack is a cloud storage unit used to store information for super computers.

Bill of Materials (BOM) for a Hydra Rack are:

- Eight Hard Drives per one Disk Enclosure
- One Disk Enclosure per one Drawer
- One Drawer per one Base
- One Base is needed per one Hydra Rack.

Below is a spreadsheet with a portion of a BOM

Level 0	Level 1	Level 2	Level 3	Level 4	
Hydra	1				
	Frame	1			
		Label1	5		
		Screw1	2		
		Bracket1	1		
		Door	1		
		Rack	1		
		Cover	2		
		Switch	1		
		Tie	48		
		Cable1	1		
	Base	1			
		Drawer1	1		
			Label2	4	
			Cardpop	1	
			Port	2	
			Disk Encl1	1	
				Hard Drive	12
				Carrier	12
				Screw2	48
	Expansion	1			
		Drawer2	1		
			Label2	4	
			Disk Encl2	1	
				Hard Drive	8
				Carrier	8
				Screw2	36

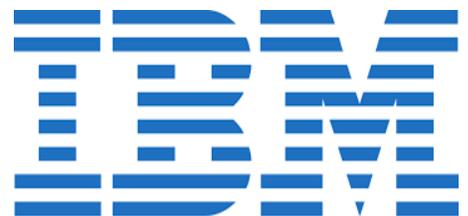
In partnership with



WAKE COUNTY  
PUBLIC SCHOOL SYSTEM



Completed Hydra Rack Assembly



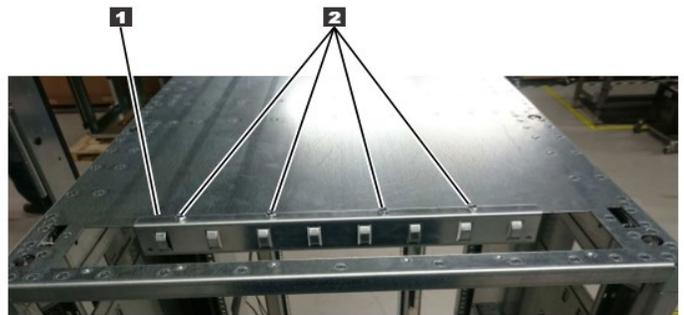
1. Organize the data, using the names of the parts needed, in a matrix for Disk Encl1 and Disk Encl2. Explain the reasoning behind the organization of your matrix.
2. Organize the amount of each component needed for one of each Disk Encl1 and Disk Encl2 in a matrix.
3. How many total components are needed to create Disk Encl1 and Disk Encl2?
4. Let's suppose we need the materials to build five Frames. Organize the total amount of each component needed to build five Frames in a matrix.

Could the data be organized in different ways within the matrix?

Does the organization of the data make a difference?

#### Frame Assembly Example

Install the top bracket **1** by using the four hex screws **2**.



5. The amount of materials you have available in your inventory for building the five Frames is listed below:

Bracket1: 250    Cable1: 100    Cover: 150    Door: 70    Label1: 310

Rack: 110    Screw1: 170    Switch: 100    Tie: 864

Do you have enough materials in your inventory to produce five Frames?

Using matrices, explain your conclusion.

What is the rationale behind the size of the matrix you chose?

6. Using the remaining inventory from question 5, how many more Frames can be built?

Using matrices show how you came up with the number of Frames.

7. Is it possible for Base Drawer components and Expansion Drawer components to be combined? Explain your conclusion.

Is there another set of components that could be combined with a Base Drawer or Expansion Drawer? Explain.

Below is a spreadsheet for the complete BOM

Level 0	Level 1	Level 2	Level 3	Level 4	
Hydra	1				
	Frame	1			
		Label1	5		
		Screw1	2		
		Bracket1	1		
		Door	1		
		Rack	1		
		Cover	2		
		Switch	1		
		Tie	48		
		Cable1	1		
	Base	1			
		Drawer1	1		
			Label2	4	
			Cardpop	1	
			Port	2	
			Disk Encl1	1	
				Hard Drive	12
				Carrier	12
				Screw2	48
	Expansion	1			
		Drawer2	1		
			Label2	4	
			Disk Encl2	1	
				Hard Drive	8
				Carrier	8
				Screw2	36
	Server	1			
		Cable2	15		
		Clip	12		
		Bracket2	5		
		Enclosure	2		
		Screw3	8		
		Assembly	2		
			Adapter	5	
			Cable3	4	
			Ram	36	
			Memory	4	



Drawer Assembly Example



Adapter Assembly Example

8. If six complete Hydra Rack units are needed, how many Assembly components will be needed? Explain two different ways the value of this situation could be found.
  
9. Let's suppose there are several different orders for a Hydra Rack Server: One going to North Carolina, two going to Canada, four going to Germany, six going to Hungary, ten going to Mexico, and seven going to China. How many components are needed for enough of the Server components for the six orders? Use a matrix to show the process for determining the number of components needed to complete the order. Is there a benefit to organizing the data in the matrix the way you chose to do it? Explain.
  
10. Your build partner Colin is trying to figure out the amount of Disk Encl1 and Disk Encl2 components needed to complete an order for Durham, NC. The company requesting the components needs six Disk Encl1's and eight Disk Encl2's.

Colin has determined the total component amount to be |360 136 352 |.

When you do the calculations, you determine the total component amount to be |136 136 576 |.

Who is correct? Explain your conclusion.