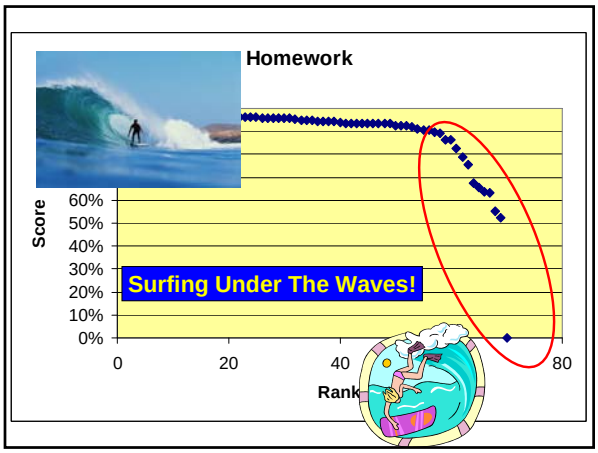
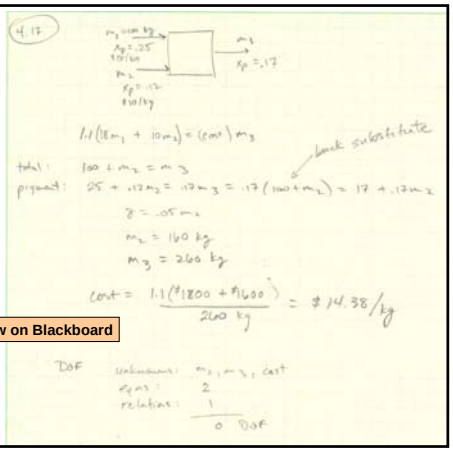


Homework Review



Answer Keys Now on Blackboard

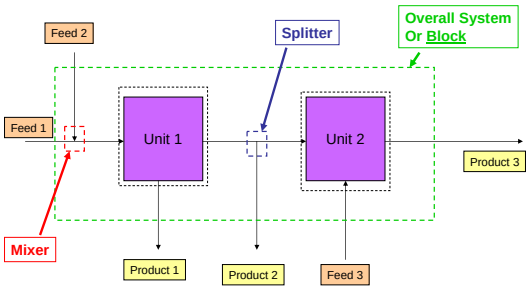
Class 8

- Procedure for solving multi-unit problems
- Mixers and splitters are units- require material balances
- Degree of Freedom analysis on multi-unit processes (non-reacting)
- Solution Strategy
- What if the strategy doesn't work?

Step 1

Take a deep breath!

Step 2: **Draw boxes around places where balances can be made (to do balances)**



(These "dashed" boxes will be called subunits)

Step 3. DOF analysis on each subunit

Subunit	Unknowns	# unknowns	# balance eqs.	# other relations	DOF
Unit 1					
Splitter					
Unit 2					
Mixer					
Block					
Process					

What is this???

How We Deal With Process DOF

- Useful to decide if the system is solvable
- U = total unknowns in the system
- BE = sum of # of balance equations on all subunits except block
- OE = sum of # of all other equations

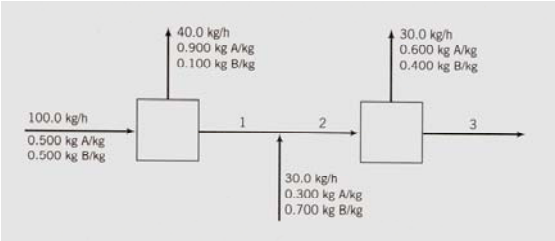
Step 4

Start finding desired unknown variables using boxes with 0 DOF

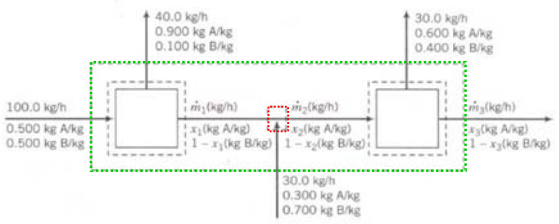
Note on Splitters

- Only one material balance can be written for a splitter because the compositions of the split streams are the same!
- Please remember this!

Practice: Define the subunits for the process below, and label unknowns for Streams 1, 2, and 3.



One way to do this:



I chose to use m_{1A}, m_{1B}, etc....

Now Do the DOF Analysis

Subunit	Unknowns	# unknowns	# balance eqs.	# other relations	DOF
Unit 1					
Mixer					
Unit 2					
Block					
Process					

Now Do the DOF Analysis

Subunit	Unknowns	# unknowns	# balance eqs.	# other relations	DOF
Unit 1	$m_{A,1}$,$m_{B,1}$	2	2	--	0
Mixer	$m_{A,1}$,$m_{B,1}$, $m_{A,2}$,$m_{B,2}$	4	2	--	2
Unit 2	$m_{A,2}$,$m_{B,2}$ $m_{A,3}$,$m_{B,3}$	4	2	--	2
Block	$m_{A,3}$,$m_{B,3}$	2	2	--	0
Process	$m_{A,1}$,$m_{B,1}$, $m_{A,2}$,$m_{B,2}$, $m_{A,3}$,$m_{B,3}$	6	6	--	0

Solution Strategy

- Start with units that have DOF = 0
- Cross out unknowns on table as they are solved for
- Systematically work through all units
- You should never need to solve more than a couple of simultaneous equations at a time

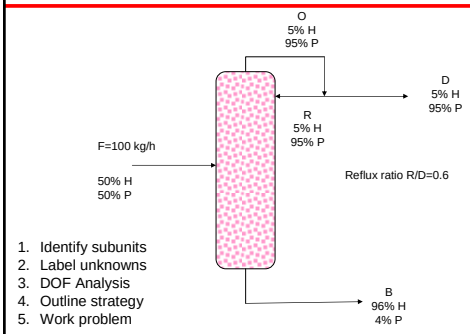
What does the DOF of the Process tell us?

Devise a solution strategy using the DOF table from the previous slide.

Now Do the DOF Analysis

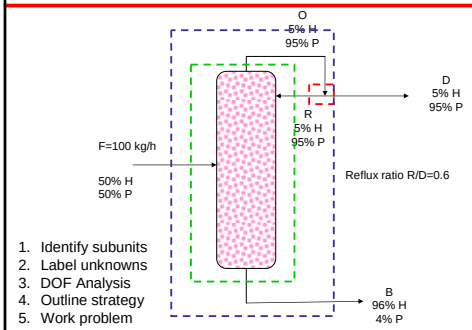
Subunit	Unknowns	# unknowns	# balance eqs.	# other relations	DOF
Unit 1	$m_{A,1}$,$m_{B,1}$	2	2	--	0
Mixer	$m_{A,1}$,$m_{B,1}$, $m_{A,2}$,$m_{B,2}$	4	2	--	2
Unit 2	$m_{A,2}$,$m_{B,2}$ $m_{A,3}$,$m_{B,3}$	4	2	--	2
Block	$m_{A,3}$,$m_{B,3}$	2	2	--	0
Process	$m_{A,1}$,$m_{B,1}$, $m_{A,2}$,$m_{B,2}$, $m_{A,3}$,$m_{B,3}$	6	6	--	0

Try this one!



1. Identify subunits
2. Label unknowns
3. DOF Analysis
4. Outline strategy
5. Work problem

Try this one!



1. Identify subunits
2. Label unknowns
3. DOF Analysis
4. Outline strategy
5. Work problem

Work on Board in Class

What if no unit has DOF = 0?

- Write down equations- sometimes you can solve for a portion of the unknowns even if you can't solve for all of them for a given unit
- Check your *other relations*- sometimes a relationship associated with one unit can be used to permit the solution of another unit
- Consider grouping units. For example, two units connected by a stream of unknown composition can sometimes be grouped together to permit solution

Look at Upcoming Homework

4.28 and 4.29