T3.5 Inventory Pooling

	Format	Formula	Summary	Applies To
T3.5 Inventory Transfer and Pooling				Current Months, Local DCs
INPUTS	No Data		None	-
Monthly Demand	Number		Sum	Month Names, Local DCs
Carryover Inventory	Number		Sum	Month Names, Local DCs
Carryover Inventory Pool	Number		Sum	Month Names
Previous Period	Month Names		None	Month Names
Fwd 3 Month Lookup	Month Names	FINDITEM(Month Names, TEXT(1 + VALUE(CODE(ITEM(Month Names))) + VAL	None	Month Names, Month Summer
Fwd 3 Month Demand	Number	Monthly Demand[LOOKUP: 'Fwd 3 Month Lookup']	Average	Month Names, Month Summer, Local DCs
Inventory Safety Stock Min	Number	"Fwd 3 Month Demand" * 1.2	Sum	Month Names, Local DCs
Max Monthly Capacity	Number		Sum	Local DCs
VARIABLES	No Data		None	-
VAR Beginning Inventory	Number		Sum	Current Months, Local DCs
VAR Scheduled Production	Number		Sum	Current Months, Local DCs
VAR Inventory Change	Number		Sum	Current Months, Local DCs
VAR Ending Inventory	Number		Sum	Current Months, Local DCs
VAR Backorders	Number		Sum	Current Months, Local DCs
VAR Send to Pool	Number		Sum	Current Months, Local DCs
VAR Take from Pool	Number		Sum	Current Months, Local DCs
VAR Inventory Pool	Number		Sum	Current Months
CONSTRAINTS	No Data		None	-
C1 Meet All Demand	Boolean	VAR Scheduled Production - VAR Inventory Change + VAR Backorders - VAR Ba	All	Current Months, Local DCs
C2 Inventory Rollover	Boolean	VAR Beginning Inventory - VAR Ending Inventory[LOOKUP: Previous Period] = C	All	Current Months, Local DCs
C3 Inventory Depletion Definition	Boolean	VAR Beginning Inventory + VAR Inventory Change - VAR Ending Inventory = 0	All	Current Months, Local DCs
C4 Cannot Exceed Max Monthly Capacity	Boolean	VAR Scheduled Production <= Max Monthly Capacity	All	Current Months, Local DCs
C5 Inventory Pool Rollover	Boolean	VAR Inventory Pool - VAR Inventory Pool[LOOKUP: Previous Period] - VAR Send	All	Current Months
C6 Cannot Dip Into Safety Stock	Boolean	VAR Ending Inventory >= Inventory Safety Stock Min	All	Current Months, Local DCs
OBJECTIVE	No Data		None	-
Minimize Unmet Demand	Number	VAR Ending Inventory + VAR Backorders * 100 + VAR Scheduled Production + V	Sum	-

Dynamic Time with Offsetting

For the **Month Names** list, note a few things:
1) There's a month before January (*Last Dec*)
2) There's a list subset called **Current Months** which excludes *Last Dec*. Optimizer processes subsets as expected, which for the purposes of the rollover means that with the exception of the first day of history, every day has a day that came before it.

When we define our constraints later on, we invoke the subset to solve just for all Current Months. This makes *Last Dec* the initialization value which we can read values from but exclude it from the feasibility population (otherwise, to calculate Last Dec, we'd have to look even further back to Last Nov, etc.)

3) Also note that the Code is the month number (as text). We'll use this in offsetting. want to know what month is Month+3 of January, we need to convert January's code "1" to number 1, add 3, then convert 4 back into the text "4" and do a FINDITEM on that.

Month Names

Tree View | **Grid View** | Properties | Subsets | Configure

View | Import... | Export... | Insert... | Delete... | Move... | Refresh

	Parent	Code	Current Months
Last Dec		0	
Jan		1	
Feb		2	
Mar		3	
Apr		4	
May		5	
Jun		6	
Jul		7	
Aug		8	
Sep		9	
Oct		10	
Nov		11	
Dec		12	

(If we want to know what month is Month+3 of January, we need to convert January's code "1" to number 1, add 3, then convert 4 back into the text "4" and do a FINDITEM on that.

Month Summer

Tree View | **Grid View** | Properties | Subsets | Configure

View | Import... | Export... | Insert... | Delete... | Move... | Refresh

	Parent	Code
Month	Forward 3 Months	0
Month+1	Forward 3 Months	1
Month+2	Forward 3 Months	2
Forward 3 Months		

Our two Local DCS (LDC1 and LCD2) have a demand forecast for the year's fulfillment.
Average demand is about 100, but LDC2 is subject to large spikes in April, August, and November.

Monthly Demand

	Last Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
LDC1	0	100	110	95	84	125	130	82	99	104	100	100	100
LDC2	0	100	100	100	200	100	100	100	400	100	100	250	100
All DCs	0	200	210	195	284	225	230	182	499	204	200	350	200

Since we're in Dynamic Time, we need to specify each period's corresponding previous period

Previous Period

Last Dec	
Jan	Last Dec
Feb	Jan
Mar	Feb
Apr	Mar
May	Apr
Jun	May
Jul	Jun
Aug	Jul
Sep	Aug
Oct	Sep
Nov	Oct
Dec	Nov

Since we're in Dyamic Time, we also can't use MOVINGSUM to average the next three months' demand for us.

Fwd 3 Month Lookup = FINDITEM(Month Names, TEXT(1 + VALUE(CODE(ITEM(Month Names))) + VALUE(CODE(ITEM(Month Summer)))))

Fwd 3 Month Lookup

	Month	Month+1	Month+2
Last Dec	Jan	Feb	Mar
Jan	Feb	Mar	Apr
Feb	Mar	Apr	May
Mar	Apr	May	Jun
Apr	May	Jun	Jul
May	Jun	Jul	Aug
Jun	Jul	Aug	Sep
Jul	Aug	Sep	Oct
Aug	Sep	Oct	Nov
Sep	Oct	Nov	Dec
Oct	Nov	Dec	
Nov	Dec		
Dec			

Now we can look at the next three months' demand for each month"

Fwd 3 Month Demand = Monthly Demand[LOOKUP: 'Fwd 3 Month Lookup']

Fwd 3 Month Demand LDC1

	Month	Month+1	Month+2	Forward 3 Months
Last Dec	100	110	95	101.7
Jan	110	95	84	96.33
Feb	95	84	125	101.3
Mar	84	125	130	113
Apr	125	130	82	112.3
May	130	82	99	103.7
Jun	82	99	104	95
Jul	99	104	100	101
Aug	104	100	100	101.3
Sep	100	100	100	100
Oct	100	100	0	66.67
Nov	100	0	0	33.33
Dec	0	0	0	0

Summary Method set to *Average*

Fwd 3 Month Demand	Monthly Demand[LOOKUP: 'Fwd 3 Month Lookup']	Average	Month Names, Month Summer, Local DCs

Since we know the forward three month average, we can multiply it by a constant to set the Minimum Safety Stock Level

Inventory Safety Stock Min = "Fwd 3 Month Demand" * 1.2

Inventory Safety Stock Min

	LDC1	LDC2
Last Dec	122	120
Jan	115.6	160
Feb	121.6	160
Mar	135.6	160
Apr	134.8	120
May	124.4	240
Jun	114	240
Jul	121.2	240
Aug	121.6	180
Sep	120	180
Oct	80	140
Nov	40	40
Dec	0	0

Constraint Equations (Written without Optimizer Syntax)

To balance out the Monthly Demand requirement it has to accounted for by one of these ways:

Scheduled Production – △ Inventory On Hand + Units Taken from Inventory Pool = Monthly Demand + Units Sent to Inventory Pool – Opened Backorders + Last Period's Open Backorders

Line Item Formula

C1 Meet All Demand VAR Scheduled Production - VAR Inventory Change + VAR Backorders - VAR Backorders[LOOKUP: Previous Period] + VAR Take from Pool - VAR Send to Pool = Monthly Demand

This Period's Beginning Inventory = Last Period's Ending Inventory (If we're in the first period, add the initial inventory that existed at Time = 0)

C2 Inventory Rollover VAR Beginning Inventory - VAR Ending Inventory[LOOKUP: Previous Period] = Carryover Inventory[LOOKUP: Previous Period]

Carryover Inventory

	LDC1	LDC2	All DCs
Last Dec	25	50	75
Jan	0	0	0
Feb	0	0	0
Mar	0	0	0
Apr	0	0	0
May	0	0	0
Jun	0	0	0
Jul	0	0	0
Aug	0	0	0
Sep	0	0	0
Oct	0	0	0
Nov	0	0	0
Dec	0	0	0

△ Inventory On Hand = This Period's Ending Inventory – This Period's Beginning Inventory

C3 Inventory Depletion Definition VAR Beginning Inventory + VAR Inventory Change - VAR Ending Inventory = 0

We can't schedule production above the monthly maximum capacity

C4 Cannot Exceed Max Monthly Capacity VAR Scheduled Production <= Max Monthly Capacity

Max Monthly Capacity

LDC1	200
LDC2	140
All DCs	340

Current Inventory In Pool = Last Period's Balance + What Was Added to Pool – What was Removed from Pool (Pool Spans all DCs)

C5 Inventory Pool Rollover VAR Inventory Pool - VAR Inventory Pool[LOOKUP: Previous Period] - VAR Send to Pool + VAR Take from Pool = 0

The Period's Ending Inventory Can't Dip Below the Specified Safety Stock Minimum (Long calc due to dynamic time OR just convert native time value to dynamic time)

C6 Cannot Dip Into Safety Stock	oolean	VAR Ending Inventory >= Inventory Safety Stock Min	All	Current Months, Local DCs