Inventories

15.511 Corporate Accounting

Summer 2004

Professor SP Kothari

Sloan School of Management

Massachusetts Institute of Technology

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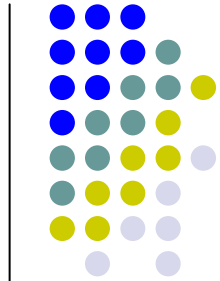
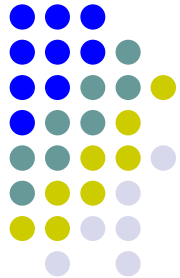
Inventory



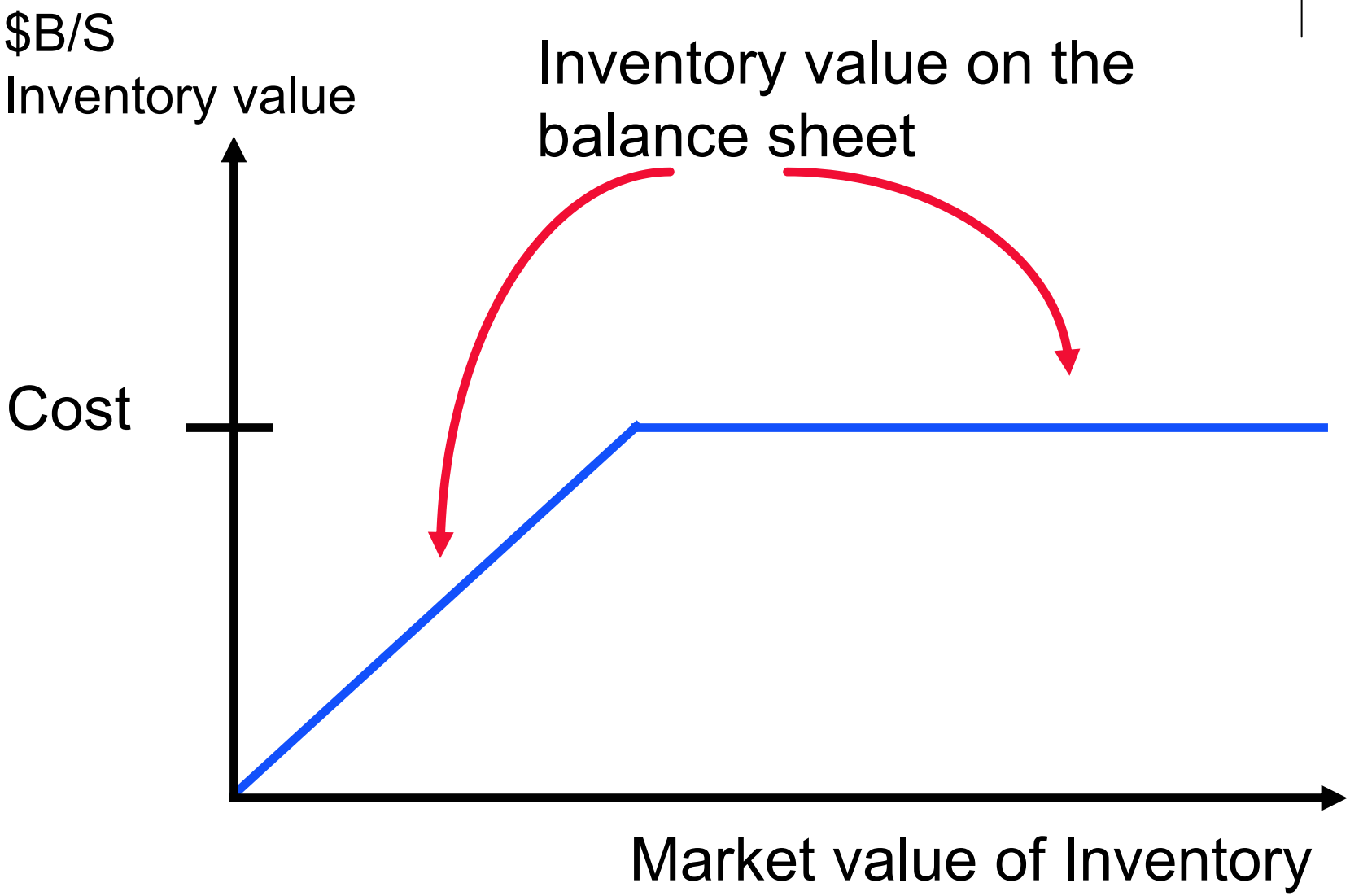
- Definition: Inventory is defined as goods held for sale in the normal course of business or items used in the manufacture of products that will be sold in the normal course of business

Inventory

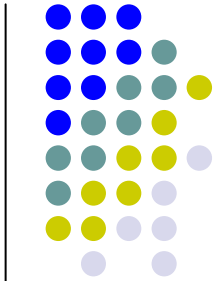


- Definition: Inventory is defined as goods held for sale in the normal course of business or items used in the manufacture of products that will be sold in the normal course of business
- Inventory is recorded on the balance sheet at the lower of the cost or the market value of the inventory.

Inventory: Lower of cost or market. Why?



Inventory



- Definition: Inventory is defined as goods held for sale in the normal course of business or items used in the manufacture of products that will be sold in the normal course of business
- The inventory is recorded on the balance sheet at the lower of the cost or the market value of the inventory.
- The cost of inventory includes all costs necessary to bring the inventory to a saleable condition.

The "Ins" and "Outs" of Inventory Accounting

The "ins" of inventory accounting

The "outs" of inventory accounting

BInv + Purchases = COGAS = COGS + EInv

Which costs ($) come out?

BInv + Purchases = COGAS = COGS + EInv

- How do we determine
  - which costs are expensed in COGS and
  - which costs remain in EInv?

➔Need a cost flow assumption

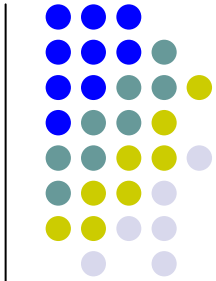
The Key Equation

Inventory

Beg. Inventory Purchases/ Production	Cost of goods sold
End. Inventory	

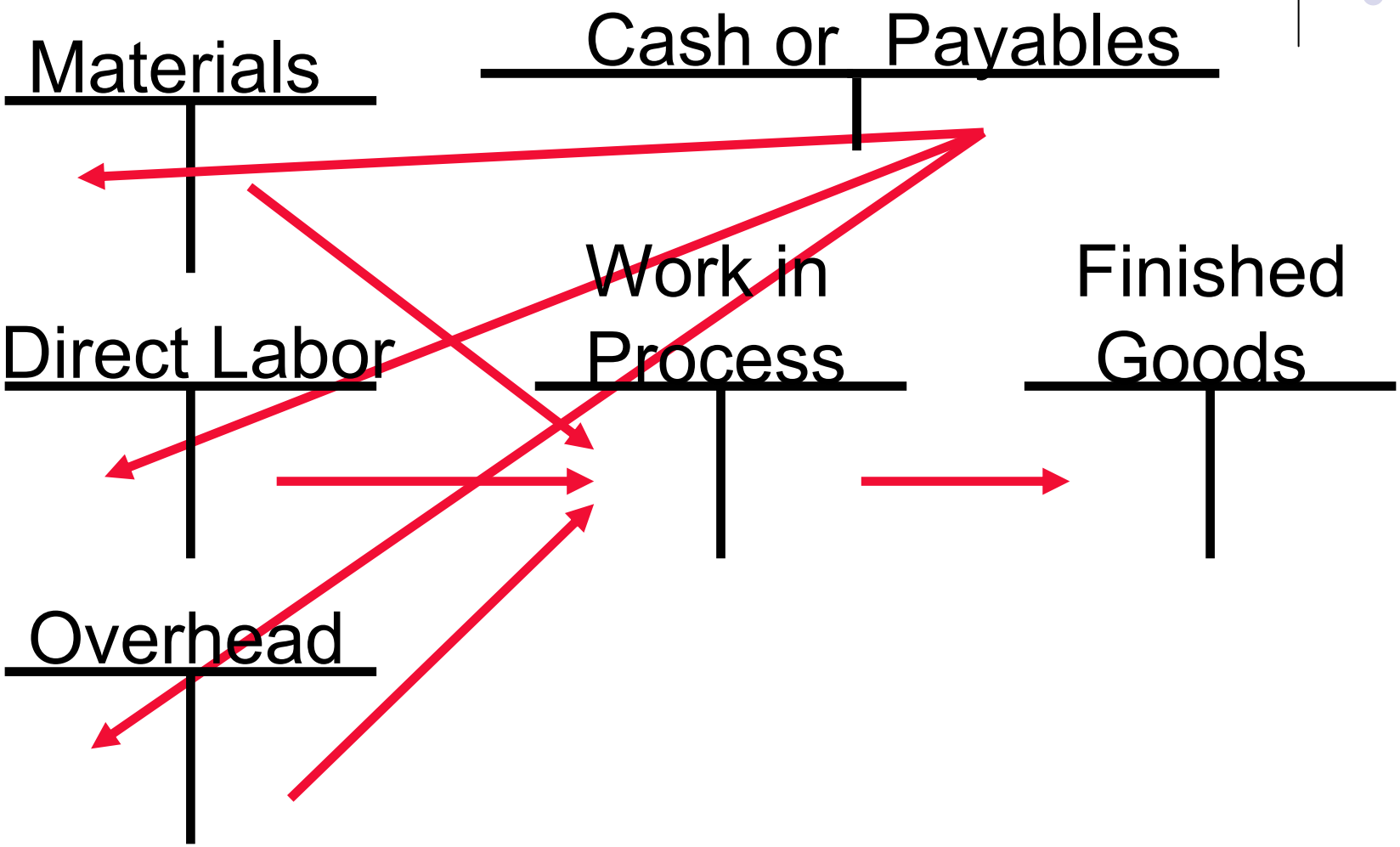
→ Beg. inventory + purchases/production - COGS = End. inventory

Which costs go in?

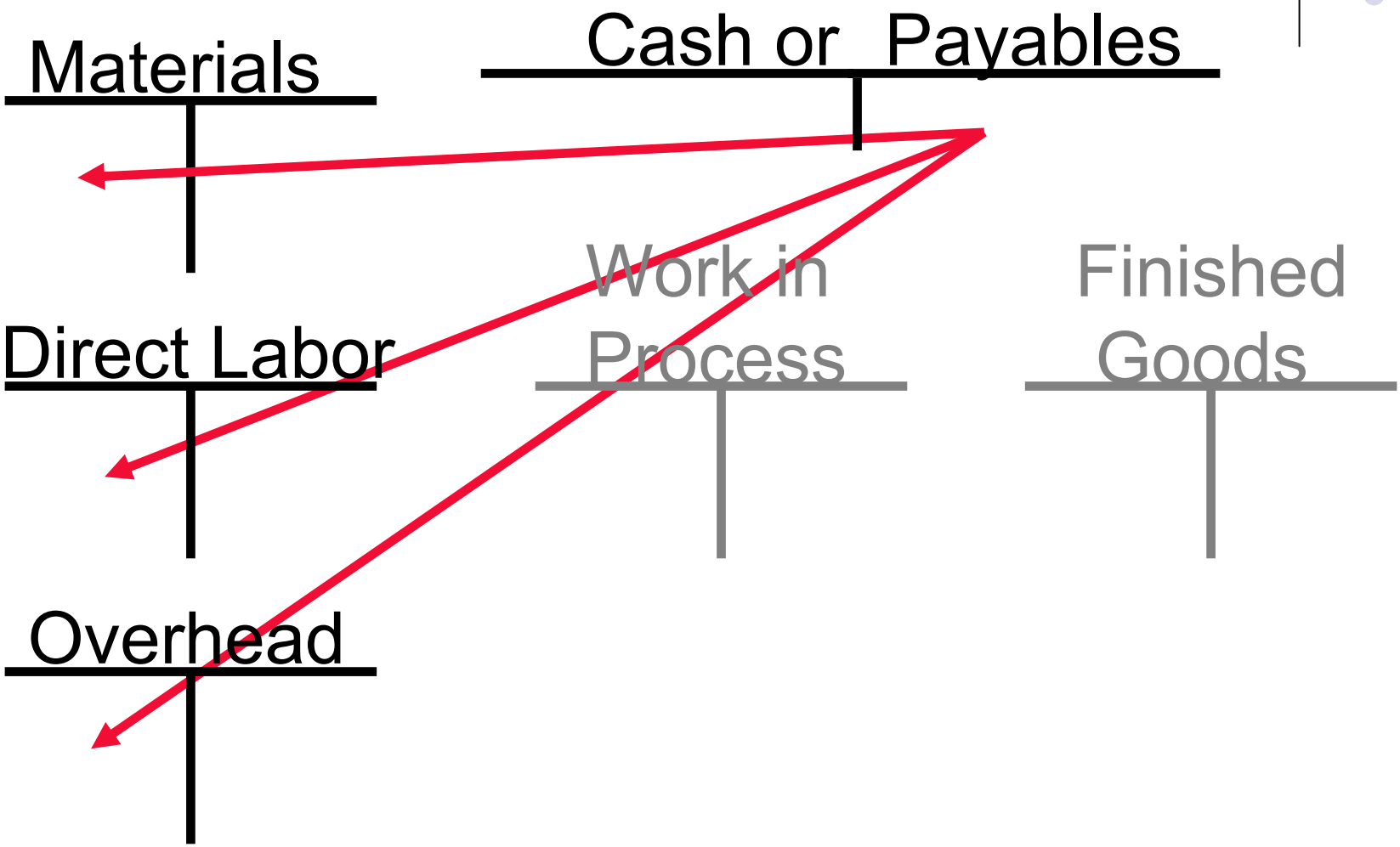


- What units to include
  - FOB shipping point or destination: who owns goods in transit?
- What costs to attach to the units
  - The cost of inventory includes all costs necessary to bring the inventory to a saleable condition.
  - All costs to acquire, manufacture, prepare
  - Includes shipping costs for retailers
  - Includes overhead costs (as well as direct labor and materials) for manufacturers
- More on this in managerial accounting …

Inventory in a Manufacturing Firm



Inventory in a Manufacturing Firm



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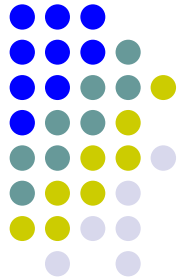
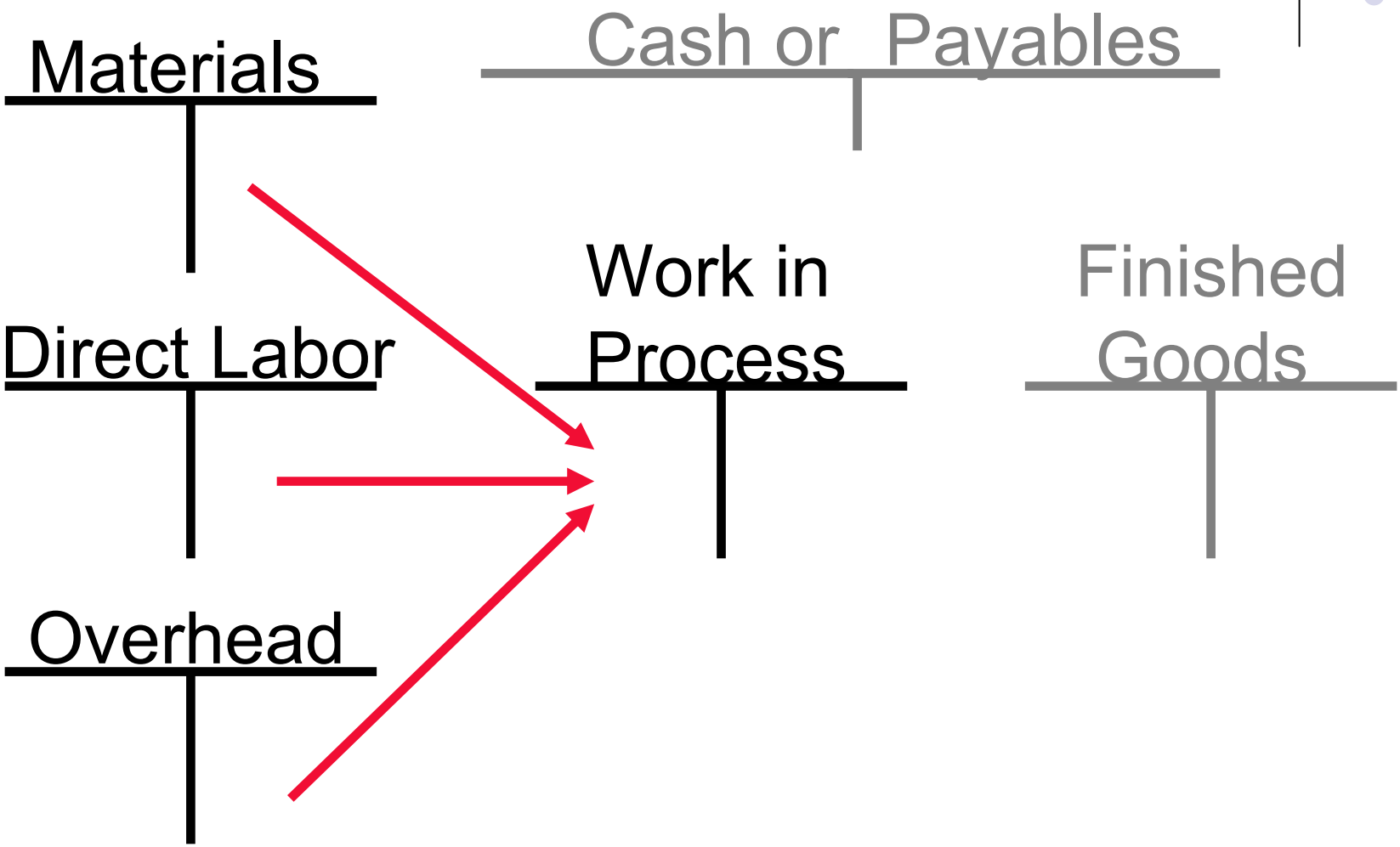


Buying of inputs

Direct Material	xx	
Direct Labor	xx	
Overhead	xx	
Payables or cash		xx

(payment of salaries, purchase of materials)

Inventory in a Manufacturing Firm



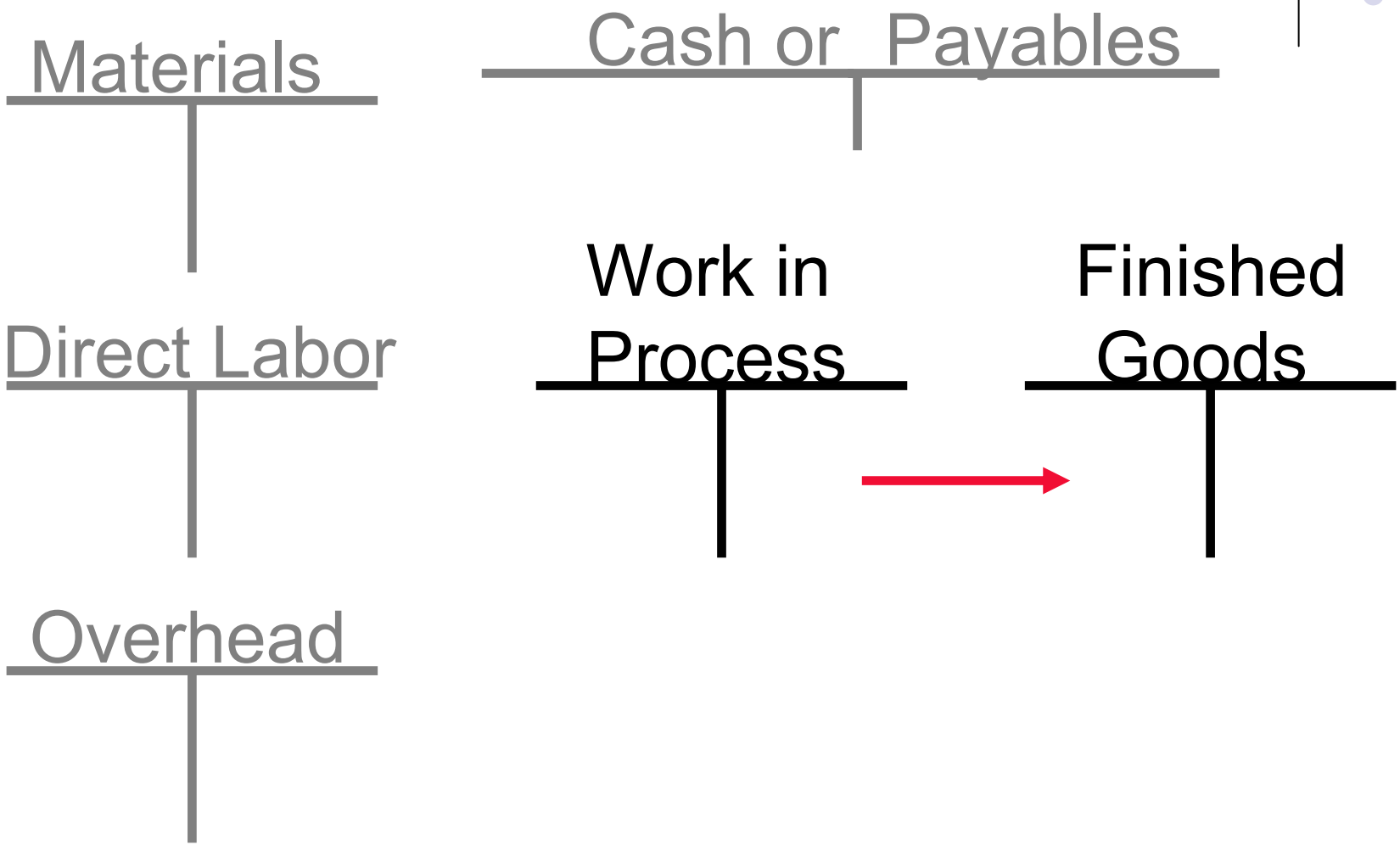
Inventory in a Manufacturing Firm

Use inputs to manufacture goods

Work in Process	xx	
Direct Material		xx
Direct Labor		xx
Overhead		xx

(Use of inputs in production)

Inventory in a Manufacturing Firm



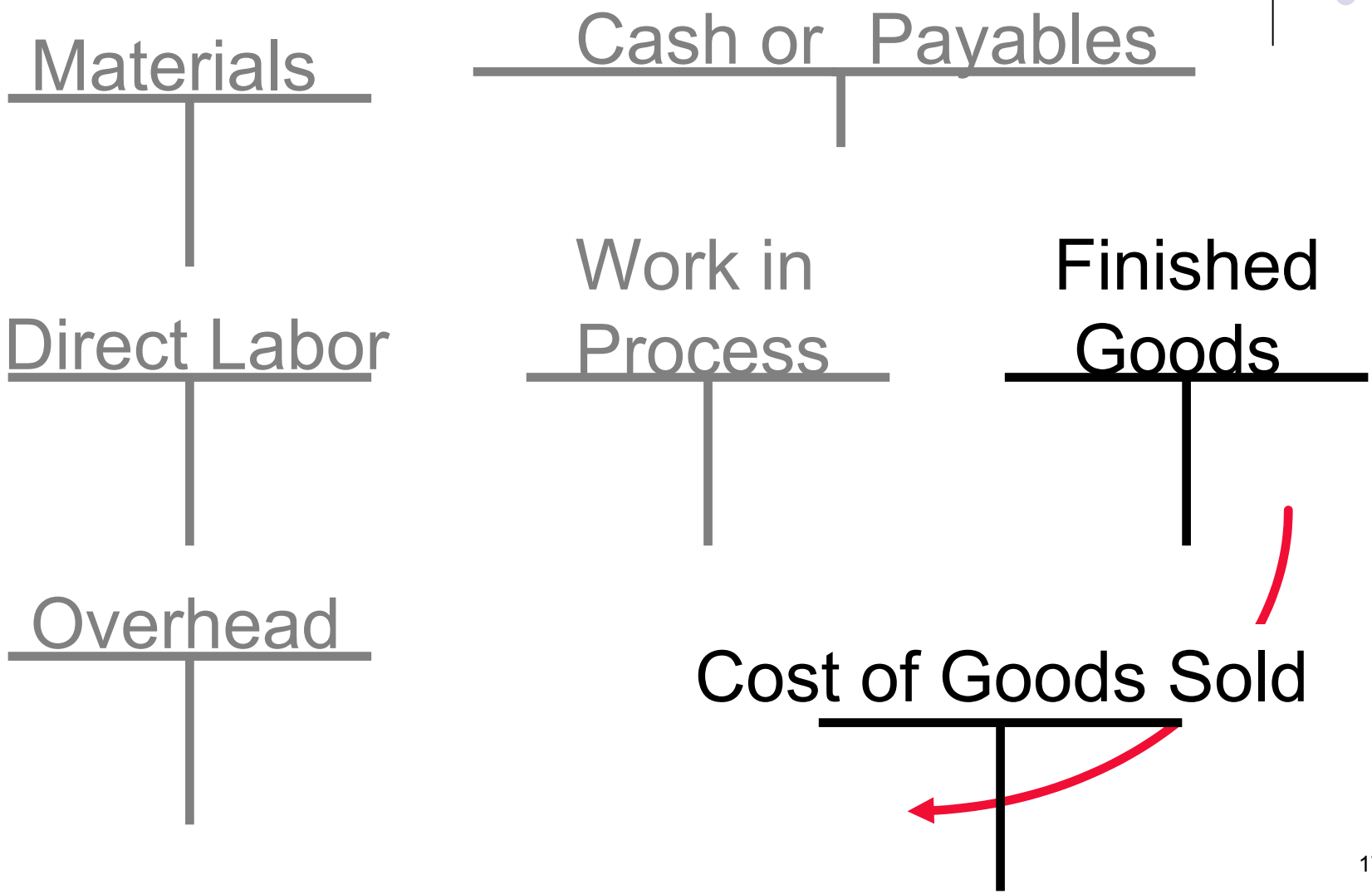
Inventory in a Manufacturing Firm

Transfer finished products from shop floor to warehouse

Finished Goods	xx	
Work in Process		xx

(production of goods completed)

Inventory in a Manufacturing Firm



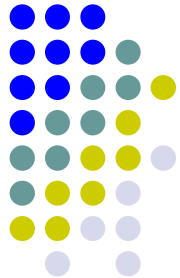
Inventory in a Manufacturing Firm

Sell goods to customers

Cost of Goods Sold	xx	
Finished Goods		xx

(finished goods are sold to customers)

Keeping track of inventory quantities: Perpetual vs. Periodic Inventory Systems



- How do we know how much has been sold?
  - *Perpetual system*: tracks units sold directly
    - more accurate, more timely, potentially more costly
  - *Periodic system*: infer quantities sold by using purchases/production, beginning and ending inventories.
    - Units sold = Beg. Units + Production – End. Units
    - harder to detect inventory "shrinkage" (e.g., theft, spoilage) as well as management fraud

Which costs ($) come out?

- BInv + Purchases = COGAS = COGS + EInv
- How do we determine
  - which costs are expensed in COGS and
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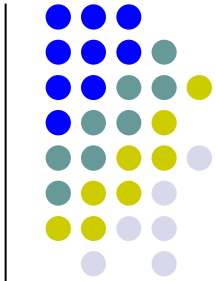
- ➔Need a cost flow assumption

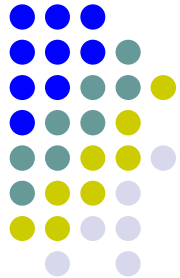
LIFO vs FIFO example



LIFO and FIFO are two assumptions about the physical flow of inventory used to determine cost of goods sold and the ending inventory account balance.

The actual physical flow of inventory need not correspond to these assumptions.

LIFO vs FIFO example



FIFO -- First In First Out

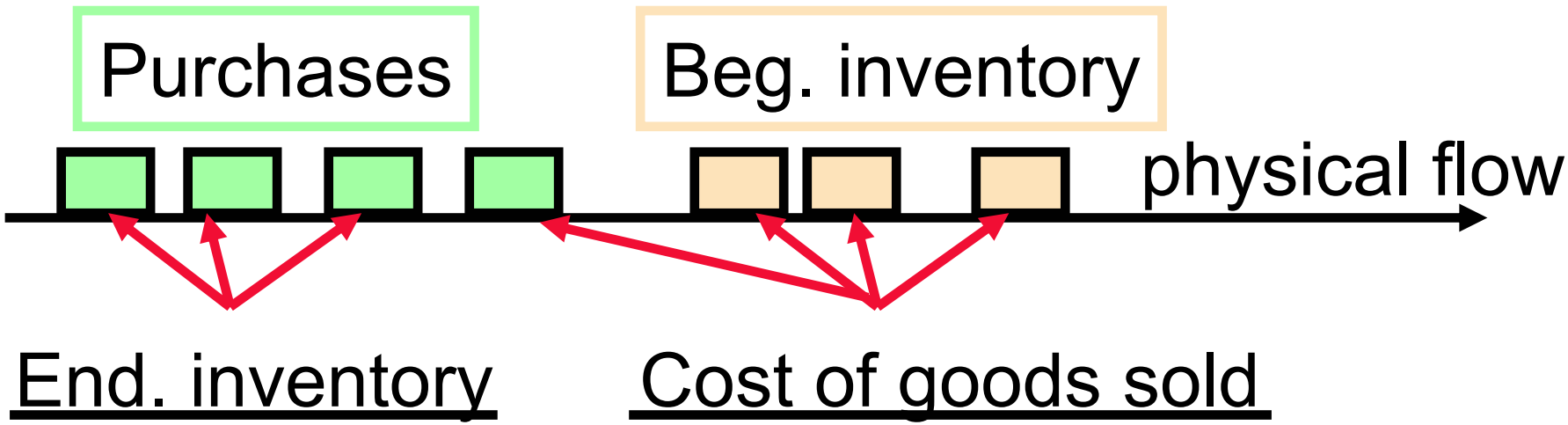
LIFO -- Last In First Out

LIFO vs FIFO example

The accountant must separate goods available for sale into End. Inv. and COGS. This separation is done based on the physical flow assumption.

FIFO – Conveyer Belt

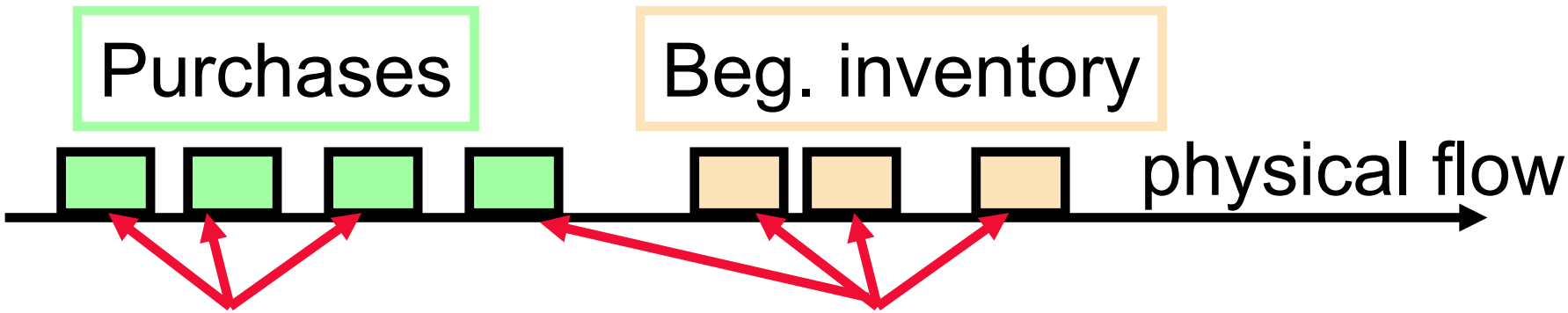
FIFO (conveyor belt)



If 4 units are sold, COGS is the purchase price of the first 4 units put on the conveyor belt.

LIFO vs FIFO example

FIFO (conveyor belt)

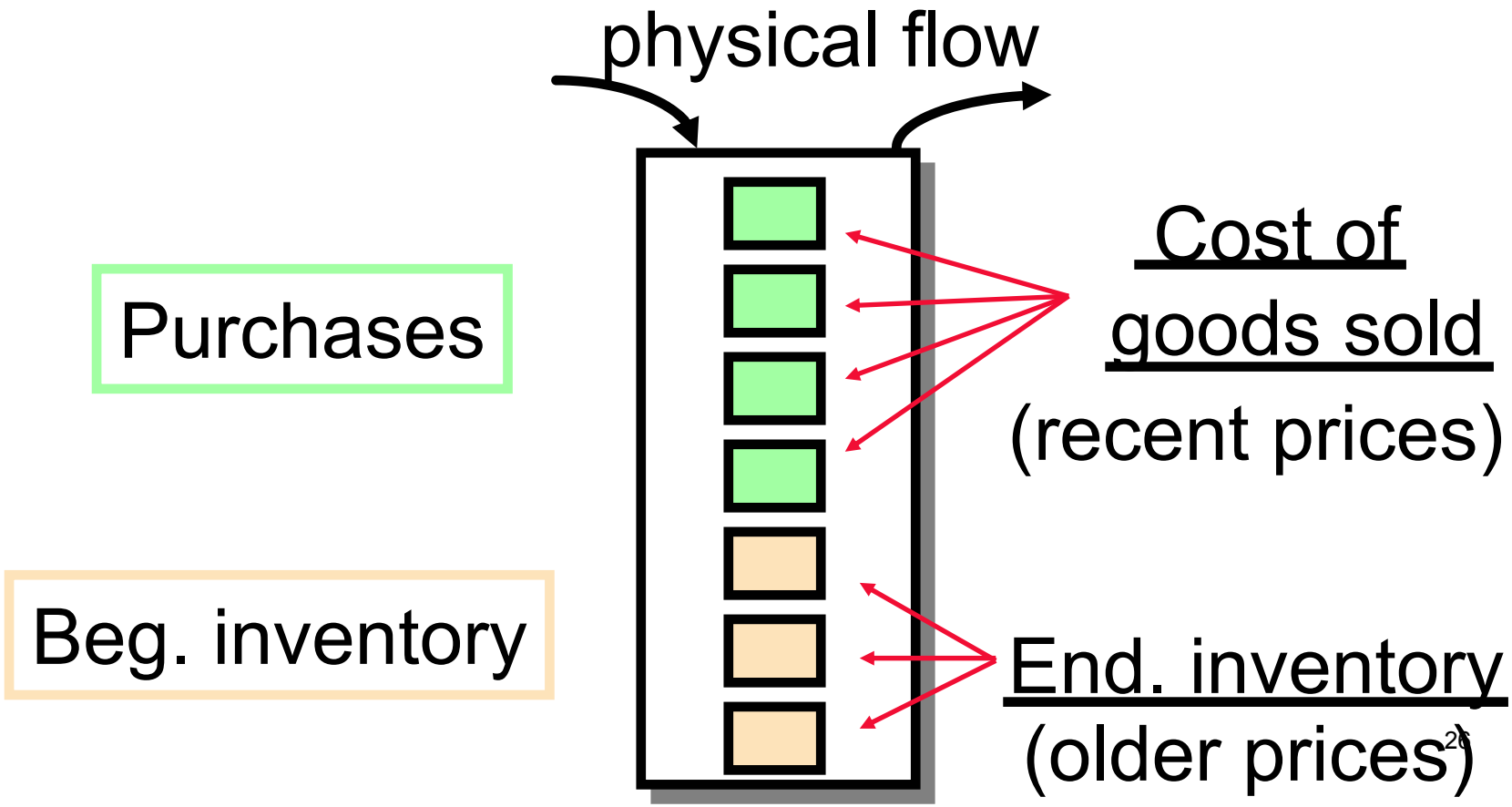


End. inventory
(recent prices)

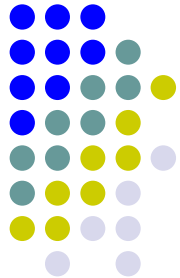
Cost of goods sold
(older prices)

LIFO – Cookie Jar

LIFO (cookie jar) -- If 4 units sold, COGS is the purchase price of last 4 units put in the jar.



LIFO vs FIFO example



Transactions:

1) Owners invest $24
2) Buy 1 unit of inventory in March for $10
3) Buy 1 unit of inventory in April for $12
4) Sell 1 unit in May for $21
5) Pay other expenses for $6

LIFO vs FIFO example - FIFO

Cash	+	Inventory	=	Liabilities	+	SE
24						24
(10)		10				
(12)		12				
21						21
(6)						(6)

FIFO cost of goods sold?

LIFO vs FIFO example - FIFO

Cash	+	Inventory	=	Liabilities	+	SE
24						24
(10)		10				
(12)		12				
21						21
(6)						(6)
		(10)				**(10)**
17		12				29

LIFO vs FIFO example - FIFO

FIFO

income statement and balance sheet

LIFO vs FIFO example – FIFO

FIFO

Sales	21
COGS	10
GM	11
Oper. Exp	6
Pretax Inc.	5

Cash	17
Inventory	12
TA	29
S. E.	29

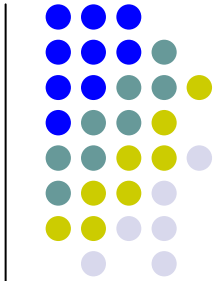
- Recent costs on B/S ←
- Old costs on the I/S ←

LIFO vs FIFO example - LIFO

Cash	+	Inventory	=	Liabilities	+	SE
24						24
(10)		10				
(12)		12				
21						21
(6)						(6)

LIFO cost of goods sold?

LIFO vs FIFO example - LIFO



Cash	+	Inventory	=	Liabilities	+	SE
24						24
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		(12)				**(12)**
17		10				27

LIFO vs FIFO example - LIFO

LIFO

income statement and balance sheet

LIFO vs FIFO example - LIFO

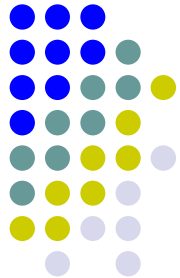
LIFO income statement and balance sheet

Sales	21
COGS	12
GM	9
Oper. X	6
Pretax Inc.	3

Cash	17
Inventory	10
TA	27
S. E.	27

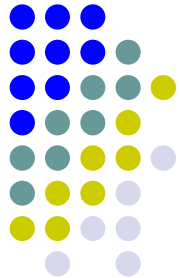
- Recent costs on I/S ←
- Old costs on the B/S ←

LIFO versus FIFO



	LIFO	FIFO
COGS	12	10
End Inv	10	12

LIFO



- Recent costs are on the income statement; LIFO matches current costs with current revenues.
- Old costs are on the balance sheet.
- Assuming increasing inventory costs, using LIFO results in a tax savings
- Using LIFO can reduce the political visibility

LIFO vs FIFO example

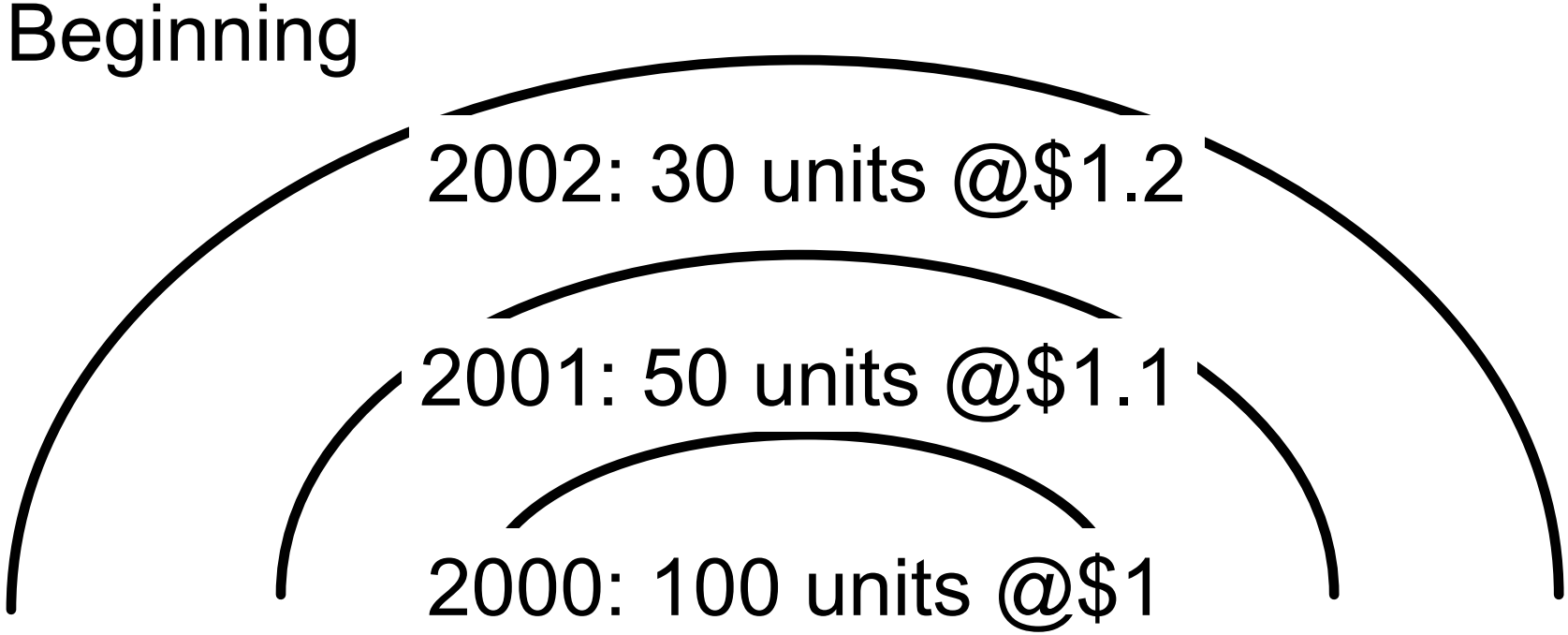
Weighted Average

Sales	21
COGS	11
GM	10
Oper. Exp	6
Pretax Inc.	4

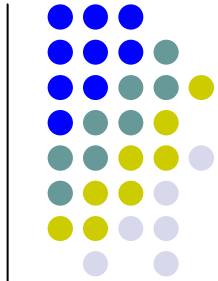
Cash	17
Inventory	11
TA	28
S. E.	28

- Mixture of old and new costs on the balance sheet and income statement

LIFO Layers example



LIFO layers and transactions



Beginning 2002: 30 units @$1.2 each
2001: 50 units @$1.1 each
2000: 100 units @$1 each

Purchase 340 units @ $2 each
Sell 500 units @ $3 each
What is LIFO COGS?

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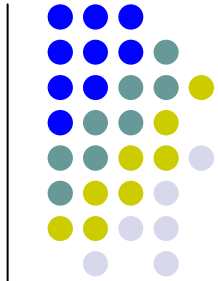


Beginning
2002: 30 units @$1.2 each
2001: 50 units @$1.1 each
2000: 100 units @$1 each
Price per unit is in $ ’000

Purchase 340 units @ $2 each

Sell 500 units @ $3 each

What is LIFO COGS?	Cumulative units
340 @ $2	340
+30 @ $1.2	370
+50 @ $1.1	420
+80 @ $1	500
= $851,000	

What is LIFO COGS?

Beginning 2002: 30 units @$1.2 each
2001: 50 units @$1.1 each
2000: 100 units @$1 each

Purchase 340 units @ $2 each
Sell 500 units @ $3 each

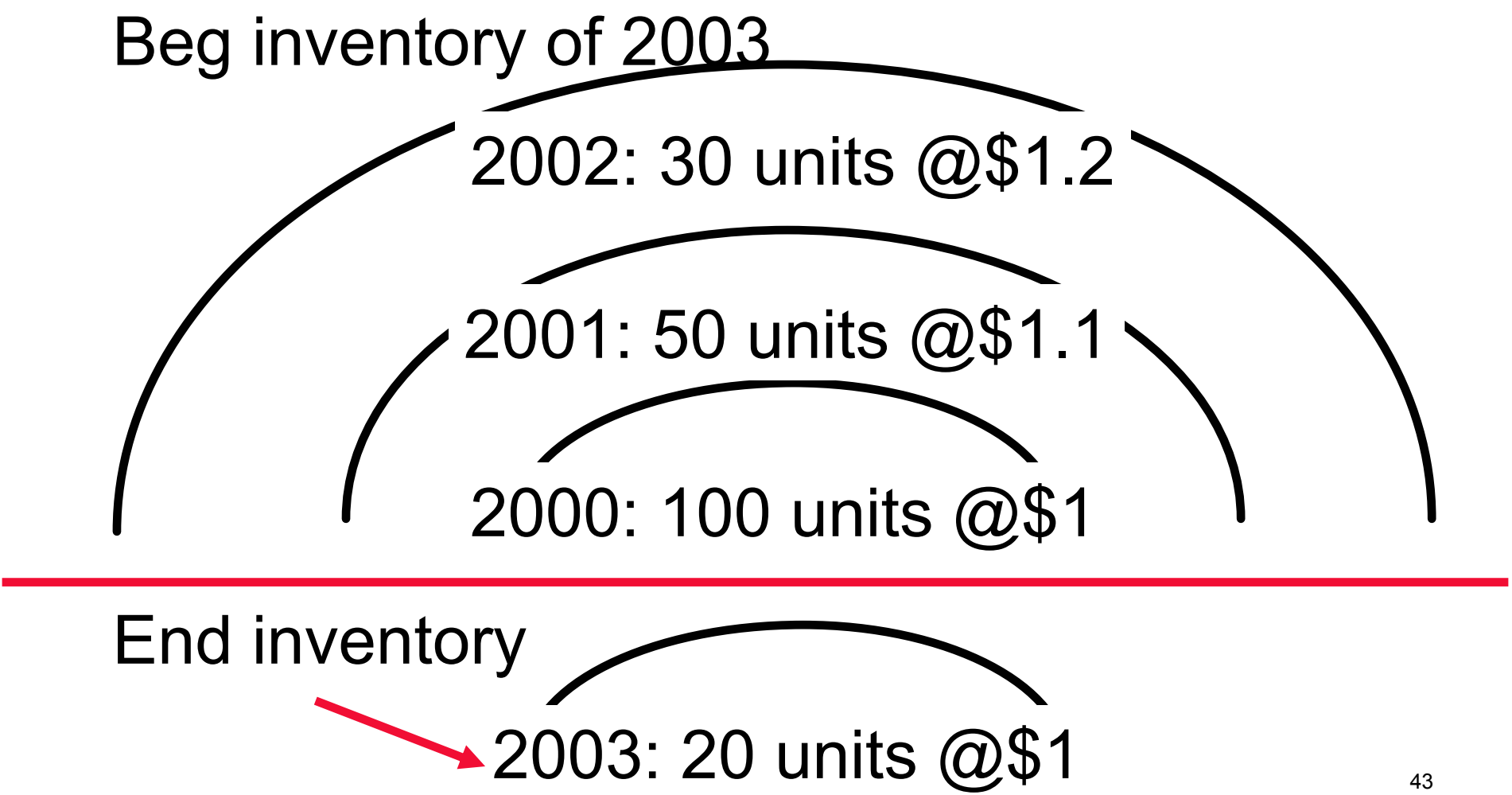
What is LIFO COGS?

340 @ $2
+30 @ $1.2
+50 @ $1.1
+80 @ $1
= $851,000

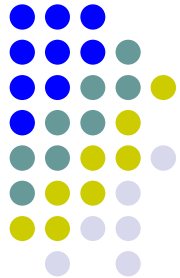
NI	
Sales	1500
COGS	(851)
EXPs	(500)
Pretax NI	149

Given

LIFO Layers example



What is LIFO COGS?

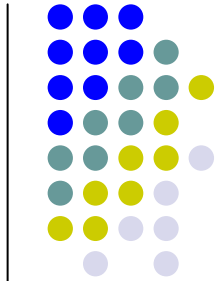


340 @ $2
+30 @ $1.2
+50 @ $1.1
+80 @ $1
= $851,000

NI	
Sales	1500
COGS	(851)
EXPs	(500)
Pretax NI	149

Assuming a 60% corporate tax rate taxes paid are $89.4 (149 X 0.6).

What is LIFO COGS?



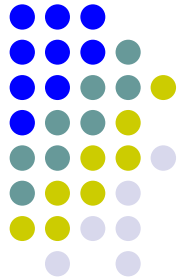
340 @ $2
+30 @ $1.2
+50 @ $1.1
+80 @ $1
= $851,000

NI	
Sales	1500
COGS	(851)
EXPs	(500)
Pretax NI	149

Assuming a 60% corporate tax rate taxes paid are $89.4 (149 X 0.6).

Company has liquidated LIFO layers and thus allowed old costs to enter into the income statement

LIFO Inventory Incentives

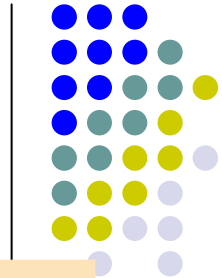


340 @ $2	500 @ $2
+30 @ $1.2	
+50 @ $1.1	
+80 @ $1	
= $851,000	=$1,000,000

Difference of
$ 149,000

If purchases had been 500 units (i.e., equal to current sales), then LIFO COGS would have been $1,000,000 ($2 X 500).

LIFO Inventory Incentives



500 @ $2 = $1,000,000

	NI
Sales	1500
COGS	(1000)
EXPS	(500)
Pretax NI	0

If purchases had been 500 units (i.e., equal to current sales), then LIFO COGS would have been $1,000,000 ($2 X 500). Pretax profits would be zero.

LIFO Inventory Incentives

NI	
Sales	1500
COGS	(851)
EXPs	(500)
Pretax NI	149

NI	
Sales	1500
COGS	(1000)
EXPS	(500)
Pretax NI	0

Company seems to lose money by purchasing inventory. If we do not liquidate any of the old inventory layers, we will have $149 less income. Thus, we had $149 of income resulting from LIFO liquidation.

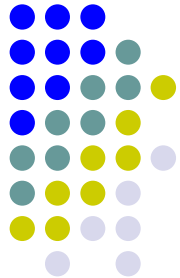
LIFO Liquidation Profits

Another way to compute LIFO liquidation profits (profits resulting from old costs appearing on the income statement):

($2 - $1.2) X 30,000
+ ($2 - $1.1) X 50,000
+ ($2 - $1.0) X 80,000
= $149,000

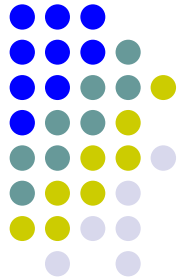
[Units in beg. inv. sold]x[Current costs - Old Costs]

LIFO vs. FIFO--Which is a Better Measure of Future Income



- If one wants to predict future cost of good sold, one would prefer the most recent measure of inventory cost of goods sold.
- LIFO provides a more recent measure of cost of goods sold than FIFO *if no LIFO liquidation occurs*.

Conversion from LIFO to FIFO -- The LIFO reserve



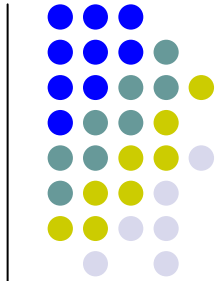
The LIFO reserve is the difference between inventory value under FIFO and the value of inventory under LIFO.

LIFO reserve = FIFO value - LIFO value

Companies using LIFO must disclose this reserve.

The LIFO reserve allows for comparison of LIFO and FIFO companies.

What is FIFO Inventory?



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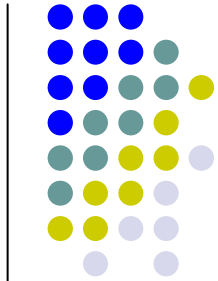
2000: 100 units @$1 each

Purchase 340 units @ $2 each

Sell 500 units @ $3 each

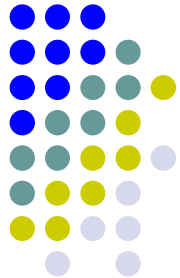
What is FIFO COGS?	Cumulative units
100 @ $1	100
+ 50 @ $1.1	150
+ 30 @ $1.2	180
+320 @ $1	320
= $831,000	

FIFO Inventory & LIFO reserve



- FIFO Ending Inventory:
  - 20 units @ $2.00 = $40
- Recall LIFO Ending Inventory:
  - 20 units @ $1.00 = $20
- LIFO reserve: $40-$20 = $20

Conversion from LIFO to FIFO -- The LIFO reserve example

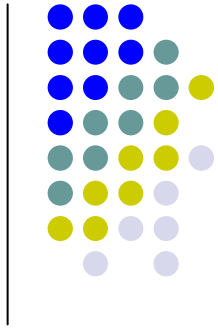


In the previous example, the company had 20 units of inventory at a LIFO value of $1 each. The FIFO value of these units would have been $2 each.

LIFO reserve = [20 X $2] - [20 X $1]
= $20,000

If inventory prices do not decrease, a decrease in the LIFO reserve indicates that old costs are appearing on the income statement.

LIFO versus FIFO COGS



Remember:

EndInv = BegInv + Purchases – COGS

=>

$Purchases_{LIFO} = (EndInv_{LIFO} – BegInv_{LIFO}) + COGS_{LIFO}$

$Purchases_{FIFO} = (EndInv_{FIFO} – BegInv_{FIFO}) + COGS_{FIFO}$

- Key: The cost of “Purchases” does not differ across LIFO/FIFO =>

  $Purchases_{LIFO} = Purchases_{FIFO}$

LIFO versus FIFO COGS

- Equating right hand side of LIFO and FIFO equations,

$$COGS_{LIFO} - COGS_{FIFO} =$$
$$(EndInv_{FIFO} – EndInv_{LIFO}) –$$
$$(BegInv_{FIFO} - BegInv_{LIFO}) +$$
$$=$$
$$\text{End LIFO reserve} –$$
$$\text{Beg LIFO reserve}$$

Footnote Disclosures

- Kmart, 2001

  "Inventories are stated at the lower of cost or market, primarily using the retail method. The last-in, first-out ("LIFO") method, utilizing internal inflation indices, was used to determine the cost for $5,537, $6,104 and $6,690 of inventory as of fiscal year end 2001, 2000 and 1999, respectively.

  Inventories valued on LIFO were $269, $194 and $202 lower than amounts that would have been reported using the first in, first out ("FIFO") method at fiscal year end 2001, 2000 and 1999, respectively."

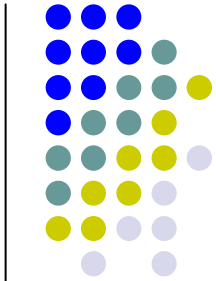
  - Kmart Corporation. *Kmart Corporation 2001 Annual Report*. 2002.

- Vacu-Dry, 1996

  "During 1996, the company liquidated certain LIFO inventories that were carried at lower costs prevailing in prior years. The effect of this liquidation was to increase earnings before income taxes by $ 642,000 ($384,000 increase in net earnings)."

  - Vacu-Dry Co. *1996 Annual Report*. 1997. (Currently called Sonomawest Holdings Inc)

Analyzing Footnote Disclosures

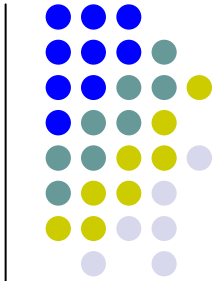


- Kmart
  - What is the value of tax savings to Kmart from using LIFO?
  - ($COGS_{LIFO}$ – $COGS_{FIFO}$)*(tax rate) =
    (Change in LIFO reserve)*tax rate =
    (269-194)*0.40 = 30

Given: tax rate = 40%

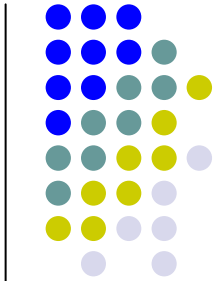
- Vacu-Dry
  - Assume change in LIFO reserve = $100,000
  - What is the difference between $COGS_{LIFO}$ and $COGS_{FIFO}$ that solely reflects a change in costs of goods produced?
  - ($COGS_{LIFO}$ – $COGS_{FIFO}$) = 100,000
  - What ($COGS_{LIFO}$ – $COGS_{FIFO}$) would have been without LIFO liquidation =
    (100+642) = 742,000

LIFO and FIFO Inventory Turnover



$$\text{Inventory turnover} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

LIFO and FIFO Inventory Turnover

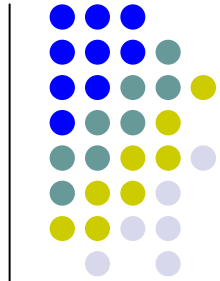


$$\text{Inventory turnover} = \frac{\text{Cost of Goods Sold}}{\text{Average Inventory}}$$

FIFO: $\frac{\text{old}}{\text{new}}$ LIFO: $\frac{\text{new}}{\text{old}}$

$$\text{New Inventory turnover} = \frac{\text{COGS(LIFO)}}{\text{Average Inventory (FIFO)}}$$

Summary for Inventories



- Inventories are carried on the balance sheet at lower of cost or market

- Alternative cost flow assumptions
  - FIFO and LIFO
  - FIFO shows balance sheet at relatively current values, but income statement cost of goods sold at stale values
  - Converse for LIFO
  - LIFO layer liquidation affects income and sometimes distorts incentives.