DEPRECIATION represents a change in value of a tangible asset due to its business use.
- Must wear out, but last longer than 1 year
- Must be used to produce income for business
- Change in valuation should match usage

IMPORTANT: ⇒ Can never depreciate land
(but can usually depreciate resources on top/underneath it!)

⇒ Depreciation is not a real cash flow
(it's tax effect is a real cash flow)
Real cash flow occurs at 1st cost & salvage

COST BASIS: Starting value to depreciate (the book value at time), and includes all direct costs to put the asset into production of income
- Purchase Price
- Shipping to production location
- Site preparation
- Installation labor and materials

Does NOT include operating costs (ongoing)

Does not include costs like:
- Vacation time (paid/unpaid)
- Benefits that are not a part of regular, daily employment
- Costs unrelated to production use of the equipment
- Costs that would/should be claimed on an individual's income taxes (business use of personal vehicle)

GRAY AREAS: - Installation costs due to a negotiated contract
- Operator training costs (employee/on-the-job training)

⇒ Discuss with a certified auditor

Sale/trade-in effects are not considered in this lecture
Two types of depreciation: Book depreciation & tax (MACRS)
EXAMPLE PROBLEM: COCKROACH CANDY BAR

COST BASIS: 8,000 \{ I = 10,000 \text{ (} B_0 \text{)} \}
2,000
SALVAGE: 1,000 \text{ (} B_A \text{ if fully depreciated)}
USEFUL LIFE: 4 \text{ yrs} = N

STRAIGHT LINE DEPRECIATION:

COCKROACH EATS \frac{1}{4} \text{ of candy bar/year}

D_n = \frac{1 - S}{N}

\begin{align*}
\frac{n}{D_n} &= \frac{10,000 - 1,000}{4} = 2,250 \\
1 &
2 & 2,250 \\
3 & 2,250 \\
4 & 2,250 \\
B_n &= 10,000 - 2,250 = 7,750 \\
7,750 - 2,250 = 5,500 \\
5,500 - 2,250 = 3,250 \\
3,250 - 2,250 = 1,000
\end{align*}

NOTE: BOOK VALUE AT END OF YEAR N = SALVAGE, ALWAYS!

REAL-WORLD EXAMPLE: CUTTING & MILLING A FIXED NUMBER OF BOARD FEET OF LUMBER FROM A TIMBER PARCEL EACH YEAR, W/O REPLANTING.
EXAMPLE (CONT.):

DECLINING BALANCE:

COCKROACH EATS A FIXED PERCENTAGE OF REMAINDER EACH YEAR, FINISHING 4TH YEAR

\[ D_n = \alpha I (1-\alpha)^{n-1} \]
\[ B_n = I (1-\alpha)^n \]

\( \alpha = \left( \frac{1}{2} \right) \) (MULTIPLIER) TYPICAL MULT: 150%, 200%

ASSUME DOUBLE DECLINING BALANCE (MULT. = 200%)

\( \alpha = \frac{1}{4} \) (200%) \[ \frac{2}{4} = \frac{1}{2} \]

\[
\begin{array}{c|c|c}
 n & D_n & B_n \\
\hline
 1 & \frac{1}{2} (10,000) = 5,000 & 10,000 - 5,000 = 5,000 \\
 2 & \frac{1}{2} (5,000) = 2,500 & 5,000 - 2,500 = 2,500 \\
 3 & \frac{1}{2} (2,500) = 1,250 & 2,500 - 1,250 = 1,250 \\
 4 & \frac{1}{2} (1,250) = 625 & 1,250 - 625 = 625 \\
\end{array}
\]

NOTE: ADJUSTMENT IS MADE WHENEVER DECLINING BALANCE DEPRECIATION WOULD RESULT IN A BOOK VALUE BELOW SALVAGE VALUE. (CANT EAT MORE THAN 100% OF CANDY BAR)

NOTES: DDB IS USED MOST FREQUENTLY, BECAUSE IT IMPROVES CASH FLOW CLOSER TO THE TIME OF ACTUAL INVESTMENT COST.

150% DB IS USED FOR VERY LONG-LIVED CAPITAL EQUIPMENT (SEWAGE PLANTS/LOW-TECH UTILITIES/WATER/STORM WATER PIPING, ...

U.S. TAX CODE USES DECLINING BALANCE & STRAIGHT-LINE DEPRECIATION TO FORM MACRS.

REAL WORLD EXAMPLE: ELECTRONIC TEST EQUIPMENT WILL TEND TO LIVE "FOREVER" AFTER A SHORT BURN-IN PERIOD, PROVIDED IT IS NOT RELOCATED (ROUGH MOVERS).
EXAMPLE (cont.):

SUM OF YEARS DIGITS: (NOT COMMON IN U.S. !)

European cockroach eats in a pattern similar to U.S. cockroach’s declining balance, and obtains an “exact” match to salvage

$$\text{SOYD} = 1 + 2 + 3 + \ldots + N; \text{ until reaching lifetime}$$

$$= \frac{N(N+1)}{2}$$

$$D_n = \frac{N-n+1}{\text{SOYD}}$$

<table>
<thead>
<tr>
<th>$n$</th>
<th>$D_n$</th>
<th>$B_n$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$\left(\frac{4}{10}\right)(9,000) = 3,600$</td>
<td>$10,000 - 3,600 = 6,400$</td>
</tr>
<tr>
<td>2</td>
<td>$\left(\frac{3}{10}\right)(9,000) = 2,700$</td>
<td>$6,400 - 2,700 = 3,700$</td>
</tr>
<tr>
<td>3</td>
<td>$\left(\frac{2}{10}\right)(9,000) = 1,800$</td>
<td>$3,700 - 1,800 = 1,900$</td>
</tr>
<tr>
<td>4</td>
<td>$\left(\frac{1}{10}\right)(9,000) = 900$</td>
<td>$1,900 - 900 = 1,000$</td>
</tr>
</tbody>
</table>

NOTE! BOOK VALUE AT YEAR $n = $ SALVAGE VALUE, ALWAYS!

NOTE: THIS METHOD PRODUCES A SIMILAR EFFECT TO THE DECLINING BALANCE (GREATER DEPRECIATION INITIALLY - SLOWER DEPRECIATION AT END, LIKE DB)

REAL WORLD EXAMPLE! SAME AS DECLINING BALANCE, BUT USED MORE COMMONLY IN EUROPE.
EXAMPLE (CONT.):

UNIT OF PRODUCTION:

COCKROACH TAKES A BITE OF CANDY BAR AND ESTIMATES THE TOTAL NUMBER OF BITES IN THE ENTIRE CANDY BAR (VOLUME OF BAR/VOL. BITE). THEN HE TRACKS DEPRECIATION AS HE ACTUALLY EATS THE BAR.

REQUIRES AN ESTIMATE OF TOTAL SERVICE UNITS AVAILABLE DURING USEFUL LIFE

\[ D_n = \left( \frac{\text{SERVICE UNITS CONSUMED DURING YEAR } n}{\text{TOTAL SERVICE UNITS AVAILABLE}} \right) (1 - S) \]

ASSUME CANDY BAR IS 500,000 COKCROACH BITES

<table>
<thead>
<tr>
<th>( n )</th>
<th>BITES TAKEN</th>
<th>( D_n )</th>
<th>( B_n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20,000</td>
<td>( \left( \frac{20,000}{500,000} \right) (9,000) = 360 )</td>
<td>10,000 - 360 = 9,640</td>
</tr>
<tr>
<td>2</td>
<td>135,000</td>
<td>( \left( \frac{135,000}{500,000} \right) (9,000) = 2,430 )</td>
<td>9,640 - 2,430 = 7,210</td>
</tr>
<tr>
<td>3</td>
<td>110,000</td>
<td>( \left( \frac{110,000}{500,000} \right) (9,000) = 1,980 )</td>
<td>7,210 - 1,980 = 5,230</td>
</tr>
<tr>
<td>4</td>
<td>60,000</td>
<td>( \left( \frac{60,000}{500,000} \right) (9,000) = 1,080 )</td>
<td>5,230 - 1,080 = 4,150</td>
</tr>
</tbody>
</table>

NOTE: BOOK VALUE AT YEAR \( n \) WILL EQUAL SALVAGE ONLY IF:

1) ESTIMATE OF TOTAL SERVICE UNITS WAS CORRECT
2) CONSUMPTION OF SERVICE UNITS ACTUALLY MET EXPECTED BY END OF YEAR \( n \) (IN TOTAL)

NOTE: COCKROACH IN EXAMPLE HAD EYES TOO BIG FOR HIS STOMACH...

REAL LIFE EXAMPLES: ESTIMATED OIL RESERVES BEING PUMPED DRY, ACTUAL BOARD FEET OF TIMBER RECOVERED FROM A STAND OF BISQUIT FIRE TREES.
**EXAMPLE (CONT.)**

**MACRS - MODIFIED ACCELERATED COST RECOVERY SYSTEM**

Cockroach must report depreciation deductions to the IRS, or they will squash him like a bug.

Assume Candy Bar is a MACRS class 5 property

\[
D_n = (\text{Year}_n \times \text{Table Value})(I)
\]

<table>
<thead>
<tr>
<th>( n )</th>
<th>MACRS %</th>
<th>( D_n )</th>
<th>( B_n )</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.00</td>
<td>((.20 \times 10000) = 2000)</td>
<td>10000 - 2000 = 8000</td>
</tr>
<tr>
<td>2</td>
<td>32.00</td>
<td>((.32 \times 10000) = 3200)</td>
<td>8000 - 3200 = 4800</td>
</tr>
<tr>
<td>3</td>
<td>19.20</td>
<td>((.192 \times 10000) = 1920)</td>
<td>4800 - 1920 = 2880</td>
</tr>
<tr>
<td>4</td>
<td>11.52</td>
<td>((.1152 \times 10000) = 1152)</td>
<td>2880 - 1152 = 1728</td>
</tr>
<tr>
<td>5</td>
<td>11.52</td>
<td>((.1152 \times 10000) = 1152)</td>
<td>1728 - 1152 = 576</td>
</tr>
<tr>
<td>6</td>
<td>5.76</td>
<td>((.0576 \times 10000) = 576)</td>
<td>576 - 576 = 0</td>
</tr>
</tbody>
</table>

**NOTES:**

MACRS \( D_n \) for most classes are a combination of DDB and straight-line depreciation, so the book value at the end of class life is always zero (fully depreciated).

MACRS assumes that asset is put into service halfway through first year (so only a half year of depreciation occurs in year 1, and an additional half year of depreciation may be taken the year after the fully depreciated asset ends its class life. (class life is not the same as useful life!)

**NOTE:** If asset is sold before the end of the class life, one half of that year's depreciation may be taken out of the taxes (and any remaining depreciation deductions are forfeited).

**REAL LIFE EXAMPLE:** Applies to any depreciable property (U.S. taxes)