**Additional Topics in Depreciation**

The topics below should be covered immediately following the discussion of Declining Balance, section 13.2.4 of the textbook.

**Sum of the Years’ Digits**

Sum of the years’ digits depreciation is a non-linear depreciation scheme whereby the largest depreciation charge is in the first year and the smallest in the last year.



where

*Dsoyd*(*n*) = the depreciation charge for period *n* using the SOYD method

*P* = the purchase price (also the book value at period 0)

*S* = the salvage price after *N* periods

*N* = the useful life, in periods

*SOYD* = sum of the years’ digits; *SOYD* = 1+2+…+*N* = (1+*N*)*N*/2

The book value at period *n* is calculated as follows:



**Example:**

If the purchase price is $10,000 and the salvage value is $1,000 after 8 years,

(a) calculate the book value at the end of year 1 and

(b) calculate the book value at the end of year 6.

**Solution:**

(a) *SOYD* = 1+2+…+8=36; *DSOYD*(1) = (8/36)(10,000 – 1,000) = 2,000.

*BVSOYD*(1) = 10,000 – 2,000 = 8,000

(b) *BVSOYD*(6) = 10,000 – [(8+7+6+5+4+3)/36](10,000 – 1,000) = 1,750

Note that one can also calculate this from the salvage value plus the depreciation amounts in years 7 and 8:

*BVSOYD*(6) = 1,000 + [(2+1)/36](10,000 – 1,000) = 1,750

**Double Declining Balance and 150% Declining Balance**

Close-up 13.1 of the textbook list the Double Declining Balance (DDB) and 150% Declining Balance (150% DB). Both methods have the straight line depreciation as their reference. In straight line depreciation the depreciation rate is 1/*N*, for an asset with a useful life of *N* years. In the case of DDB, the depreciation rate is double the straight line depreciation rate, so 2/*N* and in the case of 150% DB the depreciation rate is 1.5/*N*. In both DDB and 150% DB year 1 has the largest depreciation, and the annual depreciation decreases from one year to the next. So, the smallest depreciation occurs in year *N*.

**Example:**

**A**n asset is bought new for $1000 (*P*). It has a useful life of 8 years (*N*) and a salvage value of $200 (*S*).

Calculate the depreciation for each year, and the book value at the end of each year using both the straight line method (SL) and the DDB.

**Solution:**

*P* = 1000, *S* = 200, *N* = 8. For SL depreciation rate *d* = 1/*N* = 1/8 = 0.125; for DDB *d* = 2/*N* = 2/8 = 0.25.

For SL annual depreciation is constant: *Dsl* (*n*) = (*P* – *S*)/*N* = (1000 – 200)/8 = 100

and the book value in year n is: *BVSL*(*n*) = *P* – *n* \* *Dsl* (*n*) = 1000 – 100 *n*

For DDB the depreciation in year *n* is: *Dddb* (*n*) = *BVddb*(*n*-1) \* *d* = *BVddb*(*n*-1)/4

And the book value in year *n* is: *BVddb*(*n*) = *BVddb*(*n*-1) – *Dddb* (*n*) = *P*(1 – *d*)*n* = 1000 \* 0.75*n*

Annual depreciation and book value are shown in the table below:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | SL | | DDB | |
| Year, *n* | *D*(*n*) | *BV*(*n*) | *D*(*n*) | *BV*(*n*) |
| 0 |  | 1000 |  | 1000 |
| 1 | 100 | 900 | 250 | 750 |
| 2 | 100 | 800 | 187.5 | 562.5 |
| 3 | 100 | 700 | 140.62 | 421.88 |
| 4 | 100 | 600 | 105.47 | 316.41 |
| 5 | 100 | 500 | 79.11 | 237.30 |
| 6 | 100 | 400 | 59.32 | 177.98 |
| 7 | 100 | 300 | 44.5 | 133.48 |
| 8 | 100 | 200 | 33.37 | 100.11 |

**Capital Cost Allowance**

Canada Revenue Agency (CRA) allows corporations to decrease their taxable income by taking into account that their assets depreciate. CRA uses some special depreciation terms: Capital Cost Allowance (CCA) is the annual depreciation on the cost of certain assets and Undepreciated Capital Cost (UCC) is the book value of an asset. The Capital Cost of an asset includes not only the purchase price of the asset but may also include installation and other costs made to get the asset ready for productive use. Our textbook covers CCA in chapter 14, sections 14.8.1 and 14.8.2. One needs to review sections 14.8.1 and 14.8.2 before continuing with this section.

Capital Cost Allowance is a declining balance depreciation scheme, whereby the CRA specifies which CCA rate (equivalent to depreciation rate) must be used. CRA has identified different classes and each class has its own rate. The table below, taken from the CRA website, shows different CCA classes and their CCA rates and brief description. More extensive descriptions can be found in the link given under the Description heading. When performing the CCA analysis, all items in a particular class are grouped and the actual CCA calculations are done on the class.

**CCA classes**

(source: <http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/clsss-eng.html>, accessed 6 June 2013)

| **Class** | **Rate (%)** | **Description** (more information on each class can be found at  <http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html>) |
| --- | --- | --- |
| 1 | 4 | Most buildings you bought after 1987 and the cost of certain additions or alterations made after 1987. The rate for eligible non-residential buildings acquired after March 18, 2007, and used in Canada to manufacture and process goods for sale or lease includes an additional allowance of 6% (total 10%). For all other eligible non-residential buildings in this class, the rate includes an additional allowance of 2% (total 6%). To be eligible for the additional allowances, elections have to be filed. For more information, see [Class 1 (4%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class1). |
| 3 | 5 | Most buildings acquired before 1988 (or 1990, subject to certain conditions). Also include the cost of additions or alterations made after 1987. For more information, see [Class 3 (5%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class3). |
| 6 | 10 | Frame, log, stucco on frame, galvanized iron, or corrugated metal buildings that meet certain conditions. Class 6also includes certain fences and greenhouses. For more information, see [Class 6 (10%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class6). |
| 8 | 20 | Property that you use in your business that is not included in another class. Also included is data network infrastructure equipment and systems software for that equipment acquired before March 23, 2004. For more information, see [Class 8 (20%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class8) and [Class 46 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class46). |
| 10 | 30 | General-purpose electronic data-processing equipment (commonly called computer hardware) and systems software for that equipment acquired before March 23, 2004, or after March 22, 2004, and before 2005 if you made an election. Motor vehicles and some passenger vehicles. For more information, see [Class 10 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class10) and [Class 10.1 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class101) . |
| 10.1 | 30 | A passenger vehicle not included in Class 10. For more information, see [Class 10.1 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class101) . |
| 12 | 100 | The cost limit for access to Class 12 (100 %) treatment is $500 for tools acquired on or after May 2, 2006, and medical and dental instruments and kitchen utensils acquired on or after May 2, 2006. For more information, see [Class 12 (100%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class12). |
| 13 |  | Leasehold interest - You can claim CCA on a leasehold interest, but the maximum rate depends on the type of leasehold interest and the terms of the lease. |
| 14 |  | Patents, franchises, concessions, or licences for a limited period. Your CCA is whichever of the following amounts is less:  the total of the capital cost of each property spread out over the life of the property; or the undepreciated capital cost to the taxpayer as of the end of the tax year of property of that class. |
| 16 | 40 | Taxis, vehicles you use in a daily car-rental business, coin-operated video games or pinball machines acquired after February 15, 1984, and freight trucks acquired after December 6, 1991, that are rated higher than11,788 kilograms. |
| 17 | 8 | Roads, parking lots, sidewalks, airplane runways, storage areas, or similar surface construction. |
| 29 |  | Eligible machinery and equipment used in Canada to manufacture and process goods for sale or lease, acquired after March 18, 2007, and before 2012 that would otherwise be included in Class 43. To make an election, attach a letter to your income tax return for the tax year you bought the property indicating you are electing to put the property in Class 29. General-purpose electronic data-processing equipment (commonly called computer hardware) and systems software for that equipment, including associated data processing equipment, if acquired after March 18, 2007, and before January 28, 2009, and used in qualifying manufacturing and processing activities, that otherwise would be in Class 50. For more information, see [Class 29](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class29). |
| 38 | 30 | Most power-operated, movable equipment you bought after 1987 that was used for excavating, moving, placing, or compacting earth, rock, concrete, or asphalt.[1](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/clsss-eng.html#Footnote1) |
| 43 | 30 | Eligible machinery and equipment, used in Canada to manufacture and process goods for sale or lease that are not included in Class 29. For more information, see [Class 43 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class43). |
| 45 | 45 | General-purpose electronic data processing equipment (commonly called computer hardware) and systems software for that equipment acquired after March 22, 2004, and before March 19, 2007. For more information, see [Class 45 (45%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class45), [Class 10 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class10), [Class 10.1 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class101) , [Class 50 55%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class50), and [Class 52 (100%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class52) . |
| 46 | 30 | Data network infrastructure equipment and systems software for that equipment acquired after March 22, 2004, (if acquired before March 23, 2004, include them in [Class 8 (20%](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class8)). For more information, see [Class 46 (30%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class46). |
| 50 | 55 | General-purpose electronic data-processing equipment (commonly called computer hardware) and systems software for that equipment, including ancillary data-processing equipment acquired after March 18, 2007, and not included in Class 29 or Class 52. For more information, see [Class 50 (55%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class50). |
| 52 | 100 | General-purpose electronic data processing equipment (commonly called computer hardware) and systems software for that equipment, including ancillary data-processing equipment acquired after January 27, 2009, and before February 2011. For more information, see [Class 52 (100%)](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#class52). Also see Class 50. |

1 - You can choose to keep in a separate class any assets, including an outdoor advertising sign, you would usually include in [Class 38](http://www.cra-arc.gc.ca/tx/bsnss/tpcs/slprtnr/rprtng/cptl/dprcbl-eng.html#Class_38). To make this choice, attach a list of the assets you are including in a separate class to your income tax and benefit return for the year you bought these assets.

CCA can only be used on depreciable assets. The asset needs to have a useful life that can be determined and this useful life has to be more than one year (so e.g. land is not depreciable as the life cannot be determined). Naturally, the asset must be used by the company to produce income. (If an asset was bought in one year, but not used to produce income until the following year, there is no depreciation in the first year and depreciation can only start in the following year.)

When the CCA rate is 100%, the full amount of the capital costs can be depreciated in the year that the cost occurred (and the asset used). All assets for which the rate is less than 100% are subject to the 50% rule. This means that in the first year of use, the asset has only 50% of the normal CCA for any other year. The 50% rule applies to assets bought (and used) the beginning of the year, the middle of the year or the end of the year.

The following equations can be used for capital cost allowance calculations:

*P* = Capital Cost of an asset

*CCAn* = Capital Cost Allowance for year *n*

*d* = CCA rate

*UCCn* = Undepreciated Capital Cost for year *n*

*CCA1* = *P* (*d*/2) for *n* = 1

*CCAn* = *d* UCCn–1 for *n* ≥ 2

*CCAn* = *P d* (1 – *d*/2) (1 – *d*)*n*–2 for *n* ≥ 2

*UCCn* = *UCCn*–1 – *CCAn* for *n* ≥ 1

*UCCn* = *P* (1 – *d*/2) (1 – *d*)*n*–1 for *n* ≥ 1

In above equations the 0.5*d* component represents the application of the 50% rule. It can be easily verified that if the 50% rule is not applied (if we have *d* instead of 0.5*d*) above equations become the declining balance equations.

**Example:**

A company needed to expand their manufacturing facilities in order to increase their sales. Last year they bought a building next door for $1,500,000, additional land for $180,000 and made the additional land into a parking lot at a cost of $40,000. For these assets

a. calculate the CCA and UCC for last year,

b. calculate the CCA and UCC for the current year, and

c. calculate the CCA and UCC for five years from now.

**Solution:**

Land is a non-depreciable item. The building is Class 1. Since the building is used for manufacturing goods for sale the CCA rate is 4% + 6% = 10%. The parking lot is Class 17 with a CCA rate of 8%. Last year: n=1; current year: n=2; five years from now: n=6.

a. For the building: CCA1 = 1,500,000 \* (0.10/2) = 75,000

UCC1 = P – CCA1 = 1,500,000 – 75,000 = 1,425,000

For the parking lot: CCA1 = 40,000 \* (0.08/2) = 1,600

UCC1 = P – CCA1 = 40,000 – 1600 = 38,400

For both: CCA1 = 75,000 + 1,600 = 76,600

UCC1 = 1,425,000 + 38,400 = 1,463,400

b. For the building: CCA2 = 0.1 UCC1 = 0.1\* (1,425,000) = 142,500

UCC2 = UCC1 – CCA2 = 1,425,000 – 142,500 = 1,282,500

For the parking lot: CCA2 = 38,400 \* 0.08 = 3,072

UCC2 = UCC1 – CCA2 = 38,400 – 3,072 = 35,328

For both: CCA2 = 142,500 + 3,072 = 145,572

UCC2 = 1,282,500 + 35,328 = 1,317,828

c. For the building: CCA6 = 1,500,000 \* 0.10 \* (1 – 0.10/2) \* (1 – 0.10)4 = 93,494

UCC6 = 1,500,000 \* (1 – 0.10/2) \* (1 – 0.10)5 = 841,448

For the parking lot: CCA6 = 75,000 \* 0.08 \* (1 – 0.08/2) \* (1 – 0.08)4 = 4,126

UCC6 = 75,000 \* (1 – 0.08/2) \* (1 – 0.08)5 =51,580

For both: CCA6 = 93,494 + 4,126 = 97,620

UCC6 = 841,448 + 51,580 = 893,028

**Problem**

An asset has an initial cost of $25,000, a useful life of 6 years and a salvage value of $1000.

Calculate the annual depreciation and book value using the following depreciation methods: Straight Line (SL), Sum of Years Digits (SOYD), Declining Balance (DB), Double Declining Balance (DDB), 150% Declining Balance (1.5DB) and Capital Cost Allowance (CCA) with a CCA rate of 40%. Put the results in in table and plot book value vs. time for all methods in a single graph.