hp calculators

HP 17bII+ Discounting & Discounted Cash Flow Analysis

It's About Time

The Financial Registers versus Discounted Cash Flow

Discounting a Single Sum

Discounting and Compounding

Discounting a Series of Sums

Editing

Contrasting Annuities

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IT'S ABOUT TIME:

Discounting is the process of estimating the present value of future benefits. It is adjusting future value downward because of the time lapse of having to wait to get that future amount. Ask yourself what you would rather have: $100. right now or $100. 20 years from now. The first alternative you like. The second you barely care. They are identical sums of money. The difference is you have to wait so long to get the money in the second case that you feel it practically is worthless.

Time, yes, time has affected the value of money. We see this using the financial registers. And we will see it here in talking about discounted cash flow analysis. But there is a difference in using the financial registers and using the discounted cash flow functions in your HP 17bll+. It has to do with the cash flows in the future that you are discounting.

THE FINANCIAL REGISTERS VERSUS DISCOUNTED CASH FLOW:

If it is one sum of money you are discounting or a series of equal sums of money equally spaced apart in time, we will use the financial registers. If the future value you are discounting, on the other hand, is a series of sums that vary in amount, then you must use discounted cash flow analysis to estimate the present value of such sums. We'll look at both.

DISCOUNTING A SINGLE SUM:

First, using the financial registers to discount a single sum. What is the present value of $40,000. that you are going to receive ten years from now if you discount it at 8% annually? What is this asking you? Why would you even be interested in thinking about the present value of this money? You are still going to have to wait ten years to get it, aren't you?

Well, maybe it is a trust fund that is maturing in ten years, but an investor has approached you and offered to cash you out now. Of course, for a lesser sum, since there is still that 10-year wait to get through.

<u>The Keystrokes</u>

This is annual discounting, so ensure that your calculator is set to 1 payment per year. If it is not, from the main menu, press:

> FIN
> TVM
> OTHER
> 1
> P/YR

Get back to the TVM menu:

> EXIT

Clear with 'SK' (shift key) and 'CLR DATA' and discount with these keystrokes:

> 40000
> FV
> 10
> N
> 8
> I%YR
> PV   Answer: -18,527.74

DISCOUNTING AND COMPOUNDING:

What does this mean that the present value of $40,000. discounted at 8% annually over 10 years is $18,528. (rounded)? It is saying that you could cash out that trust fund at this $18,528., take the money and put it in an 8% compound annual account (in present

value as a negative) and at the end of ten years you would have $40,000. (in future value as a positive). That is, the $40,000. ten years from now and the $18,528. today are equal in value but separated by time, under the conditions given in this example of 8% annual discounting and a 10-year time span.

You probably feel more comfortable with compounding. That is starting with a given sum and letting it grow in the future as it accumulates interest. We are all used to this concept. Well, discounting is the same thing but done in the opposite chronological direction. Compounding is starting with a present sum and watching it grow in the future. Discounting is the time reverse, starting with a given future sum and bringing it back to a present value.

Try taking that $18,528. that we calculated above and compound it forward in time under the same conditions as we discounted the $40,000.. Keystrokes for this would be:

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18527.74
PV
10
N
8
I%YR
FV   Answer: $40,000.00

</div>

Discounting and compounding are doing the same thing, just in opposite time directions of one another. Relating discounting to compounding this way may make it easier for you to grasp the concept of discounting.

DISCOUNTING A SERIES OF SUMS:

Remember, if the sums are the same, we can use the five financial registers, putting that sum into the PMT register. But, if they are different, we must use discounted cash flow. We also must use discounted cash flow if the sums are not equally spaced apart, regardless of whether or not the sums are the same each time.

From the main menu press 'FIN' and then press 'CFLO' to get to the discounted cash flow menu. Here we will work out the present value of a series of sums. First, let's get the present value of the projected incomes described below:

Estimated cash flow at the end of period 1: $30,000.
period 2: $35,000.
period 3: $50,000.

Money received at the end of a period is called an "ordinary annuity." We'll talk more about this later when we contrast it with an "annuity-payable-in-advance."

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The Discount Rate

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You are at the beginning of the first period and you are estimating that your incomes or an asset producing incomes will be those shown above. What is the value today - the present value - of these future benefits? Before we can discount them to a present value, we must decide upon the rate at which we are going to discount. This rate should reflect the rate of return you think you could earn today on an investment (remember the relationship between compounding and discounting). It should also reflect the risk, the degree of uncertainty concerning whether or not you will really earn those funds as projected. Let's use 10%.

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Entering the Flows

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In your cash flow menu if it has been cleared you should see "FLOW(0)=?," which refers to the purchase price for an asset. If it has not been cleared, press in 'SK,' the shift key, and 'CLR DATA.' The calculator will ask you: "CLEAR THE LIST?" Press 'YES' and that will bring you to "FLOW(0)=?" in the display.

HP 17bII+ Discounting & Discounted Cash Flow Analysis

We are going to consider what we pay for an asset when we talk about net present value and internal rate of return in another section. For now we will look only at future incomes. So, press '0' and 'INPUT.' That keeps cash flow 0 at zero and moves you to the next cash flow. You should now see "FLOW(1)=?" in your display.

It is time to enter our cash flows. See what follows this explanation if you want to jump ahead and view all the keystrokes in one list. First, though, we are going to go through them one at a time showing why each keystroke is necessary.
 Press in on your keyboard the first year's cash flow of $30,000. and then hit 'INPUT.' Next you should see "#TIMES(1)=1." That means the cash flow for one period only. You are not projecting that cash flow for any more than one period. It is saying next year it is going to be different. Press 'INPUT' again. That will tell the calculator you want the cash flow for one period only - it will keep the "#TIMES" at "1." And, it brings you to the next cash flow.

How Many Straight Times?

If you are not seeing this "TIMES" indication and instead you see "FLOW(2)=?," this function on timing has been turned off. Hit the 'EXIT' button once and that should bring you to the menu where you see "#T?" to the far right. Press that key and you should see "#TIMES PROMPTING: ON" come on the display briefly.

Your calculator gives you this option so that if all your cash flows are only for one period, that is, you don't have two or more consecutive periods of the same amount of cash flow, you don't have to keep telling the calculator that each cash flow is only for one period. It will just automatically retain each cash flow for one period.

Back to the Cash Flows

Let's continue with the cash flows, keeping the #TIMES function on. You are at the second cash flow. Press in '35000' and 'INPUT.' That records your next cash flow and brings you to "#TIMES(2)=1" in your display. Retain that command for one period only by pressing 'INPUT.' Now your display shows "FLOW(3)=?." Put in your last cash flow. Press '50000' and 'INPUT.'

The Calculation Menu

That is as far as you have to go. After putting in your $50,000. for the third period cash flow, "#TIMES(3)=1" comes up on your display. Leave that as it is and press the 'EXIT' key to get to the menu that will give you a choice of calculating with your cash flows. See it to the far left of the menu choices? Press 'CALC' to get into the calculation menu.

For now we will use two of these menu choices, the "I%" and "NPV." The "I%" is the rate at which you are going to discount. We had decided on 10% earlier, so press '10' and then 'I%.' Your decision should show up in the display.

Now it is time to calculate the present value. That is the function of the menu choice that reads "NPV," which stands for "net present value." Present value and net present value here are the same, because we did not record a purchase price in cash flow "0." If you read our section on net present value and internal rate of return, you will see present value and net present value can be different.

Press 'NPV.' Your answer should read on the display "NPV=93,764.09."

This means that the value today of the three future cash flows we entered discounted at 10% is $93,764. (rounded). Another way to look at it is if you purchased an asset for $93,764. and you earned those three cash flows, you would be making a 10% return per period on your investment of $93,764.

<u>The Keystrokes Used to Calculate Present Value</u>

0
INPUT
30000
INPUT
INPUT
35000
INPUT
INPUT
50000
INPUT
EXIT
CALC
10
I%
NPV   Answer: 93,764.09

<u>Try Another Example (With Two Differences)</u>

Estimated cash flow at end of period 1: $75,000.

period 2:	($25,000.)
periods 3 through 7:	$100,000./period
period 8:	$1,200,000.

Discount rate: 7%

We have two things here we didn't have in the first cash flow: a negative cash flow, meaning a loss, and equal consecutive cash flows.

<u>Don't Forget to Clear</u>

We have a new series of cash flows. So, in the cash flow menu, clear by pressing 'SK' and 'CLR DATA.' Your display will ask you if you are sure to want to clear. Hit 'YES' and that will clear all the information and bring you back to cash flow "0."

<u>Cash Flows</u>

You are ready to insert your cash flows. Again, there is no purchase price, so hit '0' and 'INPUT.' Then, '75000' and 'INPUT' for the first cash flow. Then 'INPUT' again to show you want this for one time only. That should bring you to the second cash flow. Press '25000' and then '+/-' to show it is a negative cash flow, a loss for that period. Put it in as the second cash flow now by hitting 'INPUT' and then 'INPUT' again to keep the "TIMES" at "1."

HP 17bII+ Discounting & Discounted Cash Flow Analysis

<u>Consecutive, Equal Cash Flows</u>

Put in the third cash flow with '100000' and 'INPUT.' This time, however, we want it more than one time, don't we. That is because this cash flow is the same for each period from period 3 through period 7. That is five straight periods. So, when you get to "#TIMES(3)=1" in your display after inputting the $100,000., tell your calculator you want this five straight periods by pressing '5' and 'INPUT.' You use this function any time you have consecutive, equal cash flows.

Finish up by pressing '1200000' and 'INPUT' for the fourth cash flow.

<u>Calculate Again</u>

Now you are ready to calculate. Press 'EXIT' and 'CALC.' Press '7' and 'I%' to put in the discount rate and then calculate present value by pressing 'NPV.' Answer: $1,104,795.54

<u>The Keystrokes</u>

```
0
INPUT
75000
INPUT
INPUT
25000
+/-
INPUT
INPUT
100000
INPUT
5
INPUT
1200000
INPUT
EXIT
CALC
7
I%
NPV      Answer:  1,104,795.54
```

EDITING:

You can review and change the information you have put into your cash flow menu. From the calculation menu press 'EXIT,' which brings you back to the cash flows you entered. You can use the two arrow buttons to the left of your keyboard to go up or down your entries, cash flow '0' being considered the top of the list. Press the arrow up or down key until you reach what you want to change. Key in your new number and press 'INPUT.' You could then calculate a new present value by pressing 'EXIT,' 'CALC,' and 'NPV.'

CONTRASTING ANNUITIES:

One final point on cash flows. As mentioned earlier, we have been dealing with "ordinary annuities," that is a flow of cash in which each payment is assumed to be made at the end of the period. This is often how cash flows are handled in the valuation of assets.

On the other hand, with an "annuity payable-in-advance" it is assumed the cash flow is going to come at the beginning of a period, such as payment on a net lease, paid at the outset of the lease period. You could adjust for that in your cash flow menu by putting

the first period's cash flow in "FLOW(0)," the second in "FLOW(1)," thereby pulling up all the cash flows from the end to the start of a period. For the series we just completed, the $75,000. would go into "FLOW(0)," the ($25,000.) into "FLOW(1)" and so on. This will make the cash flows worth more, since they are going to be received earlier.