ENTREPRENEURSHIP for Computer Science and Engineering

Lecture 5:

The Lifetime Value (LTV) of an Acquired Customer

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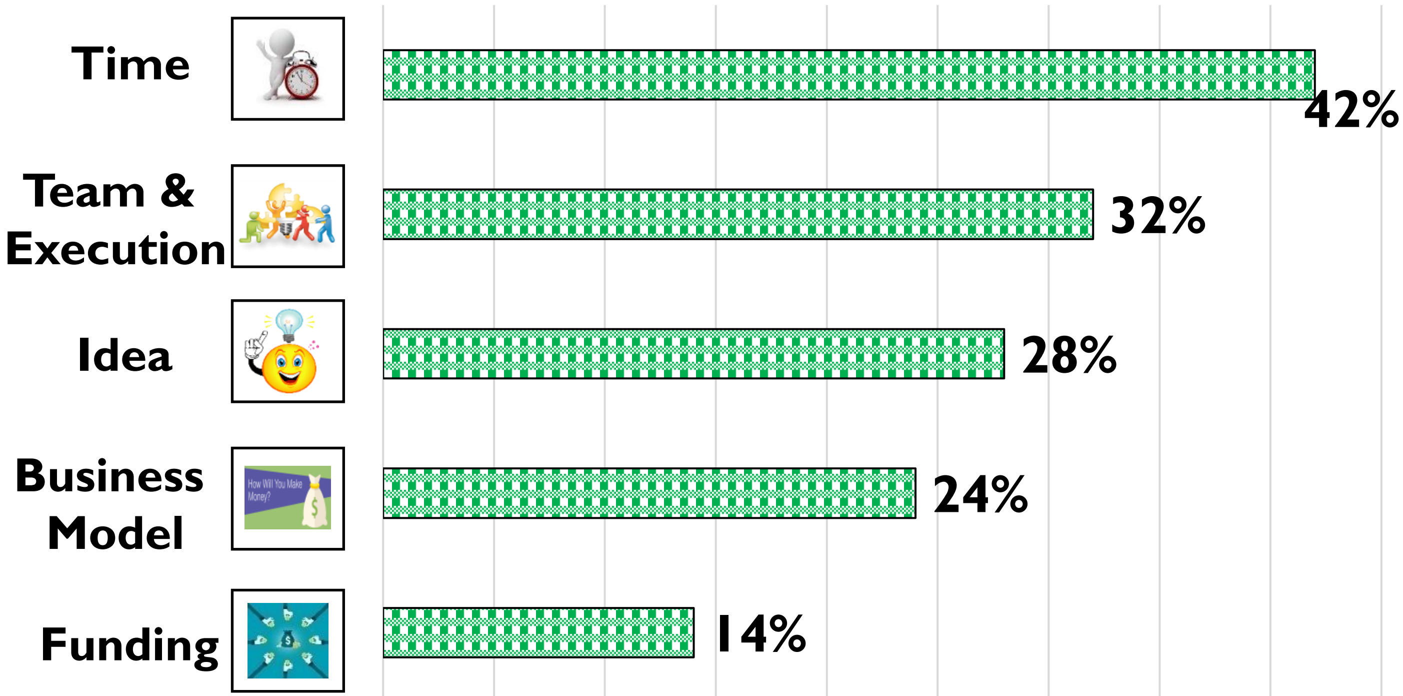
Outline

- Last Session:
  - Business models
  - Pricing frameworks
- This lecture
  - Lifetime value of an acquired customer (LTV)

- Announcements:
  - Course website: https://www.m-zakeri.ir/Entrep/
  - My Research lab: https://www.m-zakeri.ir/lab
  - Milestone 3 of the project

Recap: What makes startups succeed?

- Factors of success



Factors of success across more than 200 companies

[Based on a study by IdeaLab]

https://www.idealab.com/

Unit Economics

- Unit economics measures the revenue and costs associated with **one unit of your business**
  - A single product sold or a single customer acquired
  - Used to determine whether that unit is **profitable** and scalable.
- Toy Example
  - Inputs: Price €50, Variable Cost €30, CAC €60, repeat purchases 3.
  - Calculation:
    - Contribution = €50 - €30 = €20.
    - LTV = €20 × 3 = €60.
    - LTV:CAC = €60 : €60 = 1.
  - Verdict: The unit is not profitable to scale because LTV equals CAC;
  - The business needs higher LTV, lower CAC, or a higher contribution margin to be sustainable.

Unit Economics

- Is your venture *sustainable* and *attractive* from a microeconomic standpoint?
  - Yes,
    - if Lifetime Value of an Acquired Customer (LTV) > Cost of Customer Acquisition (COCA)
    - **Rule of thumb**: $LTV > 3 \times COCA$
  - In other words, yes, if you can acquire customers at a cost that is substantially less than their value to your venture

- **Objective of any business**: increase LTV and decrease COCA
  - Failure to do this leads to detrimental outcomes
  - (e.g., Pets.com)

Unit Economics: Pets.com as a Case Study

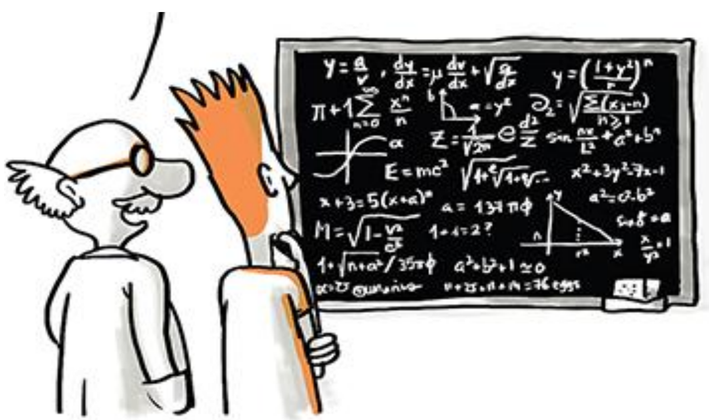
- Pets.com
  - Founded in 1998
  - **Concept**: sell pets' products over the Internet
  - Easily raised millions of dollars from investors
  - Aggressively advertised its website, including a high-profile Super Bowl commercial in 2000
  - It was losing money with each customer it captured
  - Its management assumed that it is a matter of volume (with a huge customer base, the company would become **cash-flow positive**)
    - Realized late that LTV < COCA
  - In November 2000, it shut down (300 million dollars of investors' money were lost!)

$300 million educational lesson: disciplined analysis and intellectual honesty about unit economics are crucial factors for success!

Unit Economics

- If your LTV is less than your CoCA, then you are losing money on each new customer.

Don't worry, entrepreneurial math is much simpler. If the LTV does not equal 3 times the COCA, none of this matters!

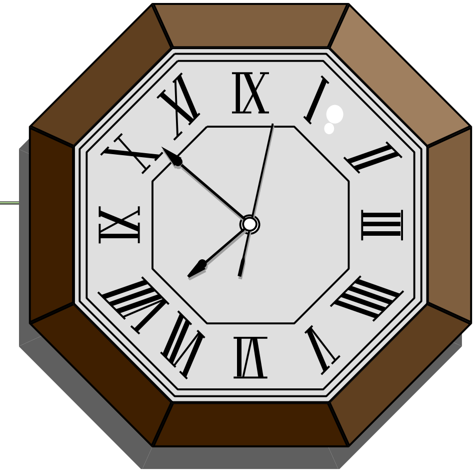


- We will first learn how to calculate LTV then COCA

- However, to calculate LTV, we need to build a foundation on some basic finance concepts, namely, ***compounding and discounting***

Let us get started!

Time Value of Money



- Money has value
  - Money can be leased or rented.
  - The payment is called interest.
- How can we treat the same amount of money available at different times?
  - If you put $100 in a bank at 9% **interest** for one time period, you will receive back your original $100 plus $9.

Original amount to be returned = $100
Interest to be returned = $100 x .09 = $9

Simple Interest

- Interest that is computed only on the original sum or principal
- Total interest earned = $I = P \times i \times n$
  - Where
    - P – present sum of money
    - i – interest rate
    - n – number of periods (years)

I = \$100 x .09/period x 2 periods = \$18

Future Value of a Loan with Simple Interest

- Amount of money due at the end of a loan
  - $F = P + P\,i\,n$ or $F = P\,(1 + i\,n)$
  - Where
    - F = future value

$F = \$100\,(1 + .09 \times 2) = \$118$

- Would you accept payment with simple interest terms?
- Would a bank?

Compound Interest

- Interest that is computed on the original unpaid debt and the unpaid interest
- Total interest earned = $I_n = P\,(1+i)^n - P$
  - where
    - P – present sum of money
    - i – interest rate
    - n – number of periods (years)

$I_2 = \$100 \times (1+.09)^2 - \$100 = \$18.81$

Future Value of a Loan with Compound Interest

- Amount of money due at the end of a loan
  - $F = P(1+i)_1(1+i)_2\ldots..(1+i)_n$ or $F = P\,(1 + i)^n$
  - Where
    - F = future value

$F = \$100\,(1 + .09)^2 = \$118.81$

- Would you be more likely to accept payment with compound interest terms?
- Would a bank?

Comparison of Simple and Compound Interest Over Time

- If you loaned a friend money for a short period of time, the difference between simple and compound interest is negligible.
- If you loaned a friend money for a long period of time, the difference between simple and compound interest may amount to a considerable difference.

Short or long? When is the $ difference significant?

You pick the time period.

Check the table to see the difference over time.

Simple and compound interest
Single payment

Principal = 100.00
Interest = 9.00%

Period	Simple amount factor	Compound amount factor
	Find Fs Given P	Find F Given P
n	Fs/P	F/P
0	100.000	100.000
1	109.000	109.000
2	118.000	118.810
3	127.000	129.503
4	136.000	141.158
5	145.000	153.862
6	154.000	167.710
7	163.000	182.804
8	172.000	199.256
9	181.000	217.189
10	190.000	236.736
11	199.000	258.043
12	208.000	281.266
13	217.000	306.580
14	226.000	334.173
15	235.000	364.248
16	244.000	397.031
17	253.000	432.763
18	262.000	471.712
19	271.000	514.166
20	280.000	560.441

Spreadsheet Functions

P = PV(i, N, A, F, type)

F = FV(i, N, A, P, type)

i = RATE(N, A, P, F, type, guess)

A = PMT(rate, nper, -pv, 0, type)

Where, i = interest rate,

N = number of interest periods,

A = uniform amount, uniform periodic payment (called the annuity payment),

P = present sum of money,

F = future sum of money,

Type = 0 means end-of-period cash payments, T

Type = 1 means beginning-of-period payments, and

guess is a guess value of the interest rate

An Example of Future Value

- If $500 were deposited in a bank savings account, how much would be in the account three years hence if the bank paid 6% interest compounded annually?

- Given P = 500, i = 6%, n = 3,
- Use F = FV(6%, 3, ,500,0) = 595.91

An Example of Present Value

- If you wished to have $800 in a savings account at the end of four years, and 5% interest we paid annually, how much should you put into the savings account?

- Given n = 4, F = $800, i = 5%, P = ?
- Use P = PV(5%, 4, ,800, 0) = $658.16

Spreadsheet Functions Example

- Monthly payment for a €10,000 loan at 6% annual interest for 5 years:
- A = PMT(6%/12, 5*12, -10000, 0, 0) = 193.33

Cash Flow Diagrams

- **Cash flow diagrams (CDF)** are graphical representations that show cash **inflows** and **outflows** plotted on a horizontal time axis, with amounts and directions marked at specific periods to summarize a project's or security's cash transactions.
- CFD illustrates the **size**, **sign**, and **timing** of individual cash flows, and forms the basis for engineering economic analysis.

An Example of Cash Flow Diagram

- A man borrowed $1,000 from a bank at 8% interest.
- Two end-of-year payments:
  - At the end of the first year, he will repay half of the $1000 principal plus the interest that is due.
  - At the end of the second year, he will repay the remaining half plus the interest for the second year.

- Cash flow for this problem is:

End of year	Cash flow
0	+$1000
1	-$580 (-$500 - $80)
2	-$540 (-$500 - $40)

An Example of Cash Flow Diagram

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End of year	Cash flow
0	+$1000
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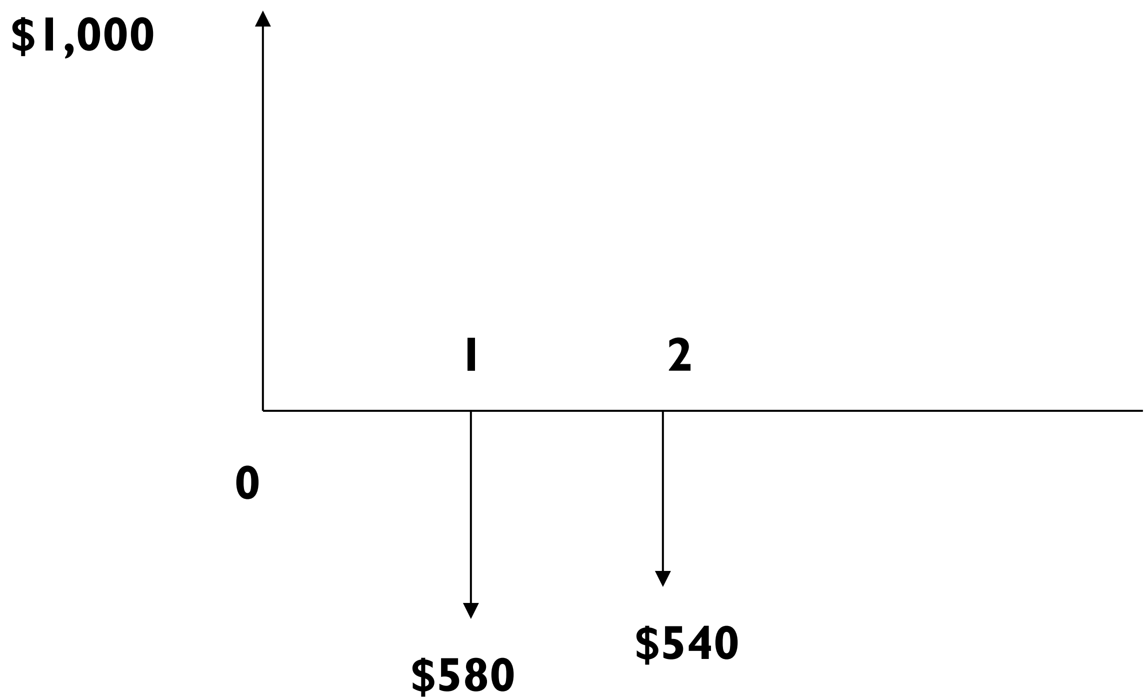
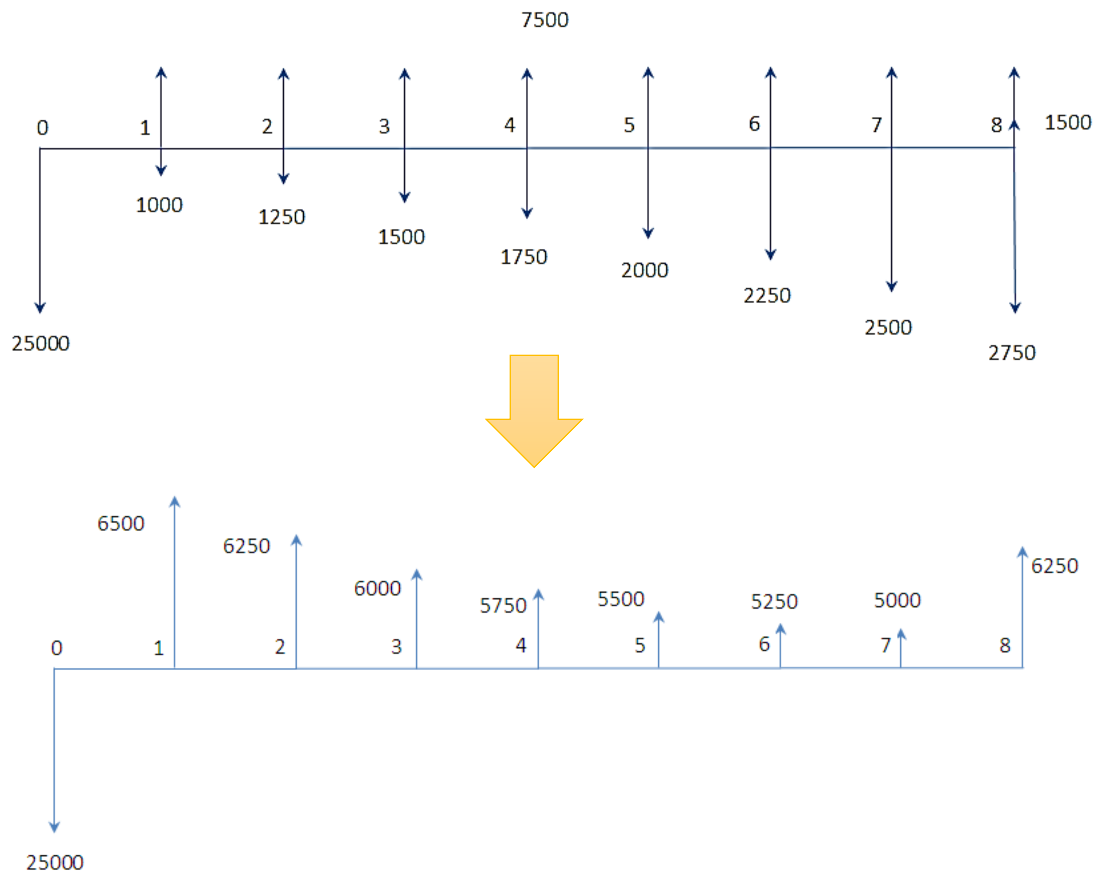


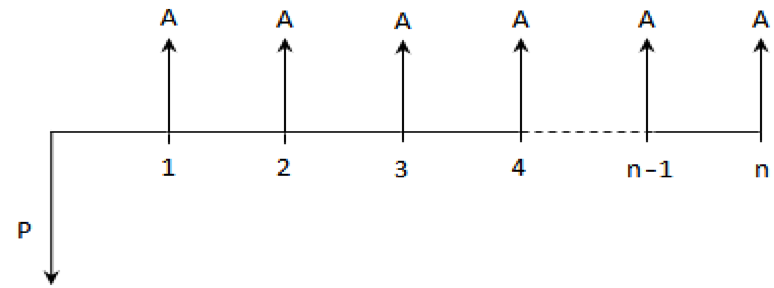
An Example of Cash Flow Diagram

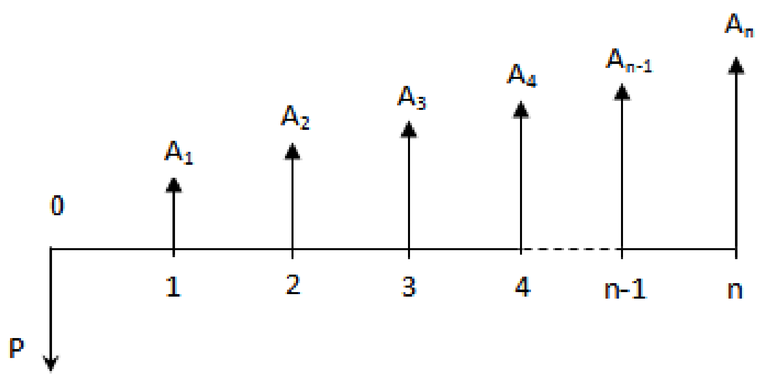
- Example



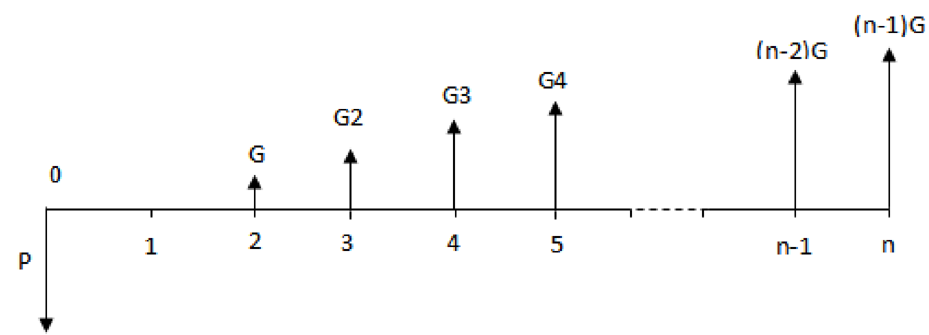
Cash Flow Diagrams

- Different cash flows



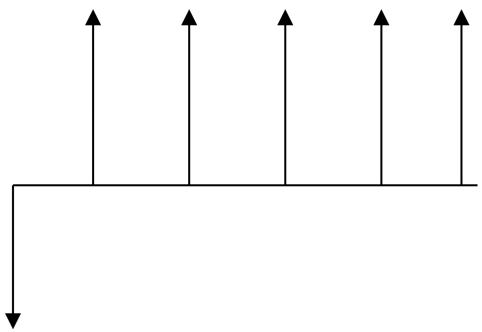


$A_m = j \times A_{m-1}$ $m>1$



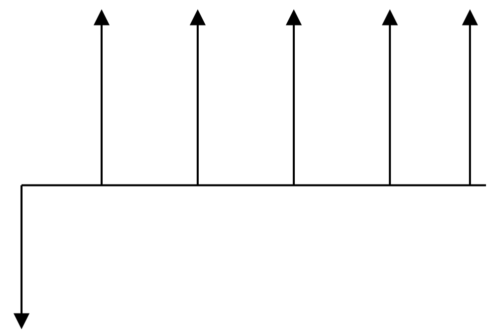
Equivalence

- Relative attractiveness of different alternatives can be judged by using the technique of equivalence
- We use comparable equivalent values of alternatives to judge the relative attractiveness of the given alternatives
- Equivalence is dependent on interest rate
- **Compound Interest formulas** can be used to facilitate equivalence computations



Technique of Equivalence

- Determine a single equivalent value at a point in time for plan 1.
- Determine a single equivalent value at a point in time for plan 2.
- Both at the same interest rate and at the same time point.
- Judge the relative attractiveness of the two alternatives from the comparable equivalent values.



The Compounding Process

- Assume you want to deposit $100 in a bank that offers a 10% interest rate that is *compounded* *annually*
  - What would be your total amount of money after 3 years?

Year	Your Money
0	\$100
1	\$100 + (\$100×0.1) = \$100 × (1+0.1) = \$100 × 1.1 = \$110
2	\$110 × 1.1 = (\$100 × 1.1) × 1.1 = \$100 × 1.1^2 = \$121

Interest is accrued on interest; hence, the name *compounded*!

The Compounding Process

- Assume you want to deposit $100 in a bank that offers a 10% interest rate that is *compounded* *annually*
  - What would be your total amount of money after 3 years?

Year	Your Money
0	$100
1	$\$100 + (\$100 \times 0.1) = \$100 \times (1+0.1) = \$100 \times 1.1 = \$110$
2	$\$110 \times 1.1 = (\$100 \times 1.1) \times 1.1 = \$100 \times 1.1^2 = \$121$
3	$\$121 \times 1.1 = ((\$100 \times 1.1) \times 1.1) \times 1.1 = \$100 \times 1.1^3 = 133.1$

The Compounding Process

- How long would it take to ***double*** your \$100, assuming 10% interest rate?
  - $\$100 \times 1.1^{n} = \$200$

    ➔ $1.1^{n} = \$2$

    ➔ $n = \log_{1.1} 2 = \log 2 / \log 1.1 = 7.272$
- Another way to calculate this quickly is to divide 72 by 10
  - 72/10 = 7.2, which is very close to 7.272 calculated above
  - This is referred to as the *"rule of 72"*, which entails dividing 72 by the given interest rate
- How long would it take to **double** your \$233, assuming 7% interest rate?
  - 72/7 = 10.28 years (or log 2 / log 1.07 = 10.244 years)

The Compounding Process

- The trick of *period* and the magical e

Compound Annually

$1 Loan

1 YEAR — **100% interest rate**

$1\times 2=\$2$

$1\times(1+1/1)^{1}=\$2$

Interest Rate

Period

Compound Semi-annually

$1 Loan

1/2 Y — **50% interest rate**

$1\times 1.5=\$1.5$

1/2 Y — **50% interest rate**

The Compounding Process

- The trick of *period* and the magical e

Compound Annually

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$1\times2=\$2$

⍰

$1\times(1+1/1)^1=\$2$

Interest Rate

Period

Compound Semi-annually

$1 Loan

1/2 Y — **50% interest rate**

$1\times1.5=\$1.5$

1/2 Y — **50% interest rate**

$1.5\times1.5=1\times1.5^2=\$2.25$

⍰

$1\times(1+1/2)^2=\$2.25$

The Compounding Process

- The trick of *period* and the magical e

Compound Annually

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$1 \times 2 = \$2$

$1 \times (1 + 1/1)^1 = \$2$

Interest Rate · Period

Compound Semi-annually

$1 Loan

1/2 Y — 50% interest rate

$1 \times 1.5 = \$1.5$

1/2 Y — 50% interest rate

$1.5 \times 1.5 = 1 \times 1.5^2 = \$2.25$

$1 \times (1 + 1/2)^2 = \$2.25$

Compound Monthly

$1 Loan

1/12 Y — 100%/12 interest rate

$1 \times 1.083 = \$1.083$

.
.
.

1/12 Y — 100%/12 interest rate

$1 \times 1.083^{12} = \$2.6$

$1 \times (1 + 1/12)^{12} = \$2.613$

Compound Daily

$1 Loan

1/365 Y — 100%/365 interest rate

$1 \times 1.00273 = \$1.00273$

.
.
.

1/365 Y — 100%/365 interest rate

$1 \times 1.00273^{365} = \$2.7$

$1 \times (1 + 1/365)^{365} = \$2.714 = e$

The Compounding Process

- The trick of *period* and the magical e

Compound Annually

$1 Loan

1 YEAR **100% interest rate**

$1\times2= \$2$

⍰

$1\times(1+1/1)^1 = \$2$

Interest Rate **Period**

Compound Semi-annually

$1 Loan

1/2 Y **50% interest rate**

$1\times1.5= \$1.5$

1/2 Y **50% interest rate**

$1.5\times1.5= 1\times1.5^2 = \$2.25$

⍰

$1\times(1+1/2)^2 = \$2.25$

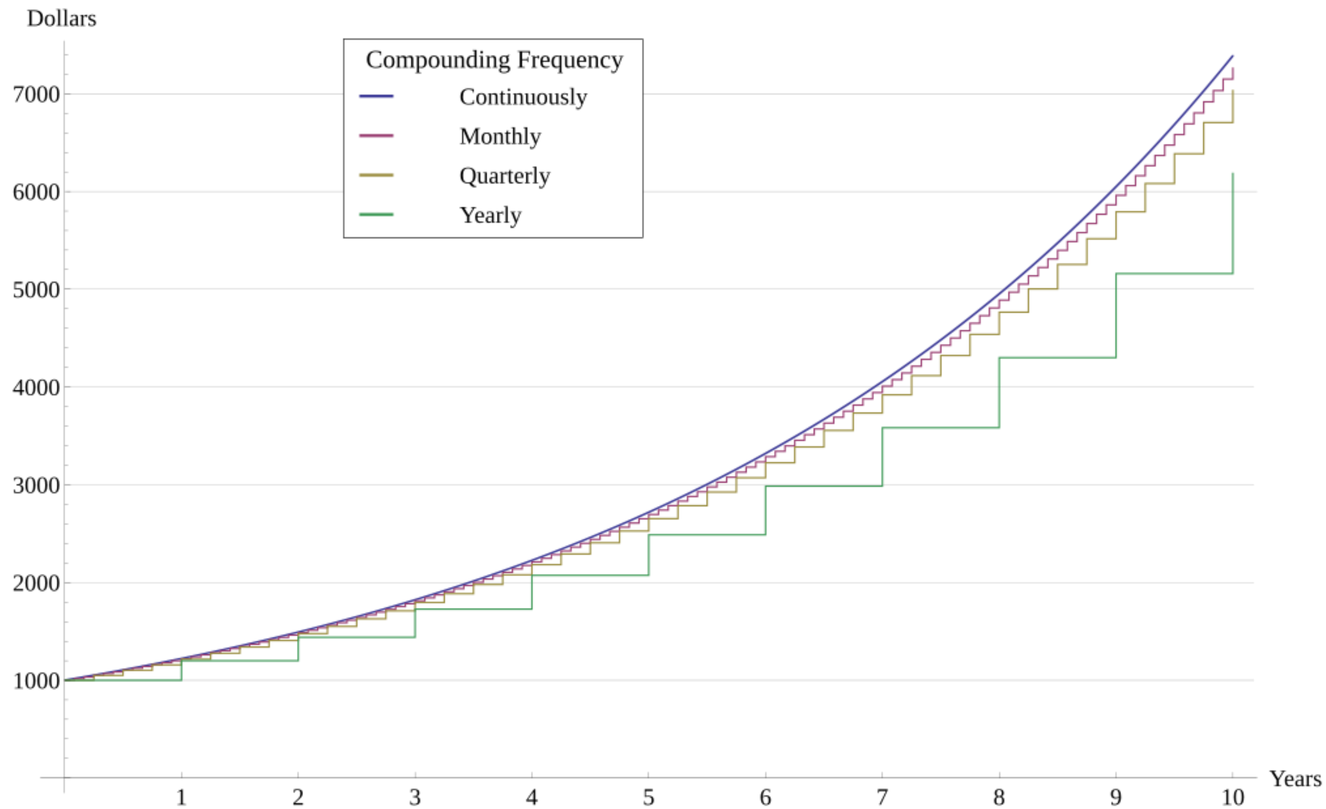
Compound Monthly

Compound Daily

*Most banks compound interest monthly or daily (this is referred to as **<u>continuous</u> compounding**)*

Compounding Frequency

- The *compounding frequency* is the number of times per given **unit of time** the accumulated interest is capitalized, on a regular basis.



Effective Annual Interest

- For the Effective Annual Interest rate, time period *t* is year, and the compounding period can be any time unit less than a year.
  - Effective interest rate at any point during the year includes the interest rate of all previous compounding periods during the year.
  - The rate $\mathbf{i_{cp}}$ per **CP** must be compounded through all **m** years to find the total effect of compounding by the end of year.
- **r**: **nominal interest** rate per year
- **m**: compounding occurs within the time period **t** (1 year).
- $\mathbf{I_{cp}}$: effective interest rate per compounding period (r/m)
- $\mathbf{I_a}$: effective interest rate per year

Effective Annual Interest

- $(1 + I_a) = (1 + I_{cp})^m$
- $\rightarrow I_a = (1 + I_{cp})^m - 1 = (1 + r/m)^m - 1$

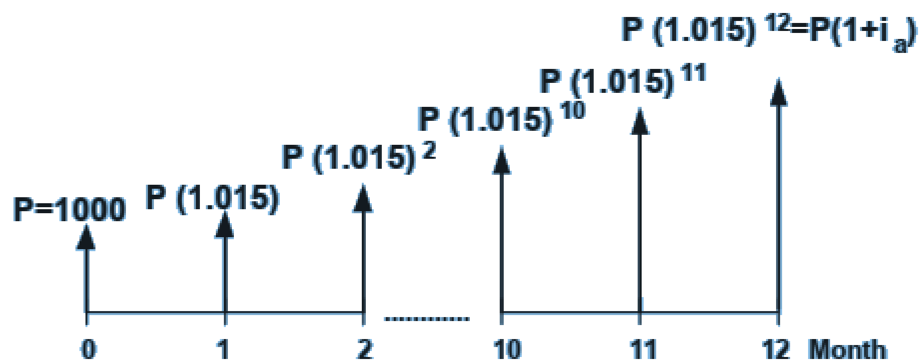
  - r: **nominal interest** rate per year
  - m: compounding occurs within the time period **t** (1 year).
  - I_{cp}: effective interest rate per compounding period (r/m)
  - I_a: effective interest rate per year

Example

- Kelso obtained a new credit card from a national bank, MBNA, with a stated rate of **18% per year**, compounded monthly.
- For a **$1,000** balance at the beginning of the year, find the effective annual rate and the total amount owed to MBNA after **1** year, provided no payments are made during the year.

Example

- Kelso obtained a new credit card from a national bank, MBNA, with a stated rate of **18% per year**, compounded monthly. For a **$1,000** balance at the beginning of the year, find the effective annual rate and the total amount owed to MBNA after **1** year, provided no payments are made during the year.
  - r (nominal annual rate)=18%, m=12,
  - i_{cp} (interest per CP)=$\frac{r}{m} = \frac{18\%}{12} = 1.5\%$ per month



  - $i_a = (1 + i_{cp})^{12} - 1 = (1.015)^{12} - 1 = 0.19562$
  - $F = 1000(1 + i_a) = 1000(1.19562) = \$1,195.62$

The Discounting Process

- Assume someone proposes to give you \$100 <u>today</u> ***or*** \$110 <u>in a year</u>
  - Which option would you select, assuming **5% *<u>risk-free</u>*** interest rate?

timeline		Option 1	Option 2
	Today (or Year 0)	**\$100** 5% ***risk-free interest rate***, compounded annually	
	Year 1	$\$100 \times (1 + 0.05/1)^1 = \$105$	**\$110**

The Discounting Process

- Assume someone proposes to give you $100 today ***or*** $110 in a year
  - Which option would you select, assuming **5%** ***risk-free*** interest rate?

timeline		Option 1	Option 2 ✓
	Today (or Year 0)	**$100**	**$110/1.05 = $104.76**
		5% ***risk-free interest rate***, compounded annually	5% ***discount rate***, discounted annually
	Year 1	**$100 × (1+ 0.05/1)^1 = $105**	**$110**

The Discounting Process

- Assume someone proposes to give you $100 <u>today</u> ***or*** $110 <u>in a year</u>
  - Which option would you select, assuming **5%** ***<u>risk-free</u>*** interest rate?

timeline		Option 1	Option 2 ✓
	Today (or Year 0)	**$100**	**$110/1.05 = $104.76** ***<u>Present Value</u>*** of $110
		5% ***risk-free interest rate***, compounded annually	5% ***discount rate***, discounted annually
	Year 1	**$100 × 1.05 = $105** ***<u>Future Value</u>*** of $100	**$110**

Discounting is the *opposite* of compounding.
In compounding, you *multiply* by (1 + interest rate), but in discounting, you *divide* by (1 + discount rate).

The Discounting Process

- Assume someone proposes to give you \$100 today *or* \$110 in a year
  - Which option would you select, assuming **5% *risk-free*** interest rate?

timeline	Option 1	Option 2 ✓
Today (or Year 0)	**\$100**	**\$110/1.05 = \$104.76** — ***Present Value*** of \$110
	5% ***risk-free interest rate***, compounded annually	5% ***discount rate***, discounted annually
Year 1	**\$100 × 1.05 = \$105** — ***Future Value*** of \$100	**\$110**

The "Present Value" concept is one of the fundamental and most useful concepts in finance!

The Discounting Process

- Assume someone proposes to give you $100 today, $110 in 2 years, ***or*** ($30 today, $30 in a year, and $40 in 2 years)
  - Which option would you select, assuming 5% *discount rate*?

	Option 1 ✓	Option 2	Option 3
Year 0	**$100**	**$\$110/1.05^2 = \$99.77$**	**$30 + $30/1.05** + $\$40/1.05^2 = 94.85$
Year 1		**$110/1.05**	**$30** **$40/1.05**
Year 2		**$110**	**$40**

The Discounting Process

- Assume someone proposes to give you $100 <u>today</u>, $110 <u>in 2 years</u>, *or* ($30 today, $30 in a year, and $40 in 2 years)
  - Which option would you select, assuming 4% *discount rate*?

	Option 1	Option 2 ✓	Option 3
Year 0	**$100**	**$110/1.04² = $101.7**	**$30 + $30/1.04** + $40/1.04² = 95.82
Year 1		**$110/1.04**	**$30** → **$40/1.04**
Year 2		**$110**	**$40**

As the discount rate decreases, the present value increases and vice versa.

Present Value

- *Present value* is the result of discounting *future value* to the present
- In general, its formula can be stated as follows:
  - $PV = \frac{FV}{(1+r)^n}$, where
    - PV = Present Value
    - FV = Future Value
    - r = Discount Rate (or *rate of return*)
    - n = Number of Periods, which could be in years, months, weeks, etc.
- Related to the concept of the *present value* is the ***net present value***

Outline

- Net Present Value ✓
- LTV Calculation

Net Present Value

- Assume you want to invest in a business \$10,000
  - Can you pay off this investment in 3 years, assuming a discount rate of 5% and the following cash inflows?
  - Goal: Determine if the investment pays off — i.e., if the present value (PV) of future returns is ≥ \$10,000

	Cash Outflow	**Cash Inflow**	**Cash Inflow**	**Cash Inflow**
Year 0	**\$10,000**			
Year 1		**\$3,000**		
Year 2			**\$4,000**	
Year 3				**\$5,000**

There is a ***Time Value of Money*** (e.g., \$10 today is worth more than \$10 in a year) because of inflation and earnings that could be potentially made using the money during the intervening time; hence, a *discount*!

Net Present Value

- Assume you want to invest in a business $10,000
  - Can you pay off this investment in 3 years, assuming a discount rate of 5% and the following cash inflows?
  - Goal: Determine if the investment pays off — i.e., if the present value (PV) of future returns is ≥ $10,000

	Cash Outflow	**Cash Inflow**	**Cash Inflow**	**Cash Inflow**
Year 0	**$10,000**	$\$3,000/1.05 = \$2857.14$	$\$4,000/1.05^2 = \$3628.11$	$\$5,000/1.05^3 = \$4319.18$
Year 1		**$3,000**		
Year 2			**$4,000**	
Year 3				**$5,000**

Net Present Value

- Assume you want to invest in a business $10,000
  - Can you pay off this investment in 3 years, assuming a discount rate of 5% and the following cash inflows?
  - Goal: Determine if the investment pays off — i.e., if the present value (PV) of future returns is ≥ $10,000

	Cash Outflow	Cash Inflow	Cash Inflow	Cash Inflow	$\sum Cash\ Inflows$
Year 0	**$10,000**	$2857.14	$3628.11	$4319.18	$10804.44
Year 1		**$3,000**			
Year 2			**$4,000**		
Year 3				**$5,000**	

Net Present Value

- Assume you want to invest in a business $10,000
  - Can you pay off this investment in 3 years, assuming a discount rate of 5%?
  - Goal: Determine if the investment pays off — i.e., if the present value (PV) of future returns is ≥ $10,000

	Cash Outflow	$\sum Cash\ Inflows$	$(\sum Cash\ Inflows) - Cash\ Outflow$
Year 0	**$10,000**	$10804.44	$10804.44 – $10,000 = 804.44
Year 1			
Year 2			
Year 3			

✓ **YES,** you can **pay off** your investment in 3 years

Net Present Value

- **Net Present Value (NPV)** is a *capital budgeting tool* that can be used to analyze the profitability of a projected investment or project
  - NPV = PV(All Cash Inflows) – PV(Cash Outflow)
  - If NPV > 0 accept; otherwise, reject!
- More formally, $NPV = \sum_{n=1}^{N} {C_n}/{(1+r)^n} - C_0$, where
  - N = Number of time periods
  - C_n = Net cash inflow during period *n*
  - C_0 = Net cash outflow (or total initial investment)
  - r = Discount rate

Outline

- Net Present Value
- LTV Calculation ✓

LTV as a KPI

- **Key performance indicator (KPI)** is a type of performance measurement.
- KPIs evaluate the success of an organization or of a particular activity (such as projects, programs, products and other initiatives) in which it engages.
- KPIs are used not only for business organizations but also for technical aspects such as machine performance.
- Many KPIs are developed and managed with **customer relationship management (CRM)** software.
  - *https://www.kpi.org/kpi-basics/kpi-development/*
- **LTV in marketing and sales**

Key Inputs to Calculate LTV

1. Revenue channels
   - This depends on your business model
     - E.g., One-time, up-front revenue channel, *if any*
     - E.g., Recurring revenue stream, like subscription fee, maintenance fee, or purchases of consumables, *if any*
     - E.g., Additional revenue opportunities like revenue from add-on products, *if any*
2. Gross margin for each of your revenue channels
   - $Gross\ margin\ =\ price - production\ cost$
   - **Note**: "Production" cost does not include sales, marketing, administrative, and overhead (e.g., R&D) costs

Key Inputs to Calculate LTV

3. **Retention rate**
   - This is the percentage of customers who will continue to pay for your product
   - The opposite of retention rate is "**churn rate**," which is the percentage of customers you lose.
   - Early termination of a contract by the customer should be incorporated into the retention rate.
4. Life of product
   - This is the duration you expect your product will last before the customer either discontinues using it or purchases a replacement
5. Next product purchase rate
   - This is the percentage of customers who will buy a replacement product from you when the life of the current product ends

Key Inputs to Calculate LTV

6. Cost of **capital rate** for your business
   - This is how much it costs you (in debt or equity) to get money from investors for your business (it is actually the *discount rate*)
   - For a new entrepreneur who lacks a track record and is just starting, an appropriate number is between 35% and 75%
   - (also, *the riskier your venture is, the higher the number*)

How to Calculate LTV?

- **Algorithm**:

```
LTV = 0
for each year y
        for each revenue channel in your business model
          if in y the customer will replace your product then
                use "gross margin", "retention rate" (if any), and
                "next product purchase rate" to calculate your profit p
        else
                use "gross margin" and "retention rate" (if any)
                to calculate your profit p
        total_profit += 0000p
        calculate the present value, pv, of total_profit in y
        LTV += pv
        total_profit = 0
```

Example: “Widget”

- Assume a conceptual case of a company that makes a “widget”
- Widget’s business model involves a one-time, up-front charge for the widget, alongside an annual recurring fee for maintenance

	One-time Revenue	Recurring Maintenance Revenue
Widget Price	$10,000	15% of the up-front charge after a 6-month warranty period
Gross Margin	65%	85%
Retention Rate	-	100% in year 0 and 90% in subsequent years
Life of Product	5 years	5 years
Next Product Purchase Rate	75%	75%
Cost of Capital Rate	50%	50%

Towards Calculating LTV for "Widget"

- **Revenue Channel 1**: One-time, up-front payment for a widget
  - How much *profit* can be made out of this channel?

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of a Widget	$10,000	0	0	0	0	$10,000
Next Product Purchase Rate						0.75
Gross Margin of a Widget	0.65					0.65
Profit from a Widget	$(10{,}000 \times 0.65) = \$6{,}500$	0	0	0	0	$(10{,}000 \times 0.75 \times 0.65) = \$4{,}875$

Towards Calculating LTV for "Widget"

- **Revenue Channel 2**: Maintenance for a widget
  - How much *profit* can be made out of this channel?

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cost of Maintenance	\$750	\$1500	\$1500	\$1500	\$1500	\$750
Retention Rate (say, r)	1	0.9	0.9	0.9	0.9	
Cumulative r (= r^y, where y = number of years after year 0)	1	(0.9^1) = 0.9	(0.9^2) = 0.81	(0.9^3) = 0.729	(0.9^4) = 0.656	0.656
Next Product Purchase Rate						0.75
Gross Margin of Maintenance	0.85	0.85	0.85	0.85	0.85	0.85
Profit from Maintenance	(750 × 1 × 0.85) = \$637.5	(1500 × 0.9 × 0.85) = \$1,147.5	(1500 × 0.81 × 0.85) = \$1,032.75	(1500 × 0.729 × 0.85) = \$929.48	(1500 × 0.656 × 0.85) = \$836.40	= (750 × 0.656 × 0.75 × 0.85) = \$313.65

Calculating LTV for "Widget"

- **Lifetime Value of An Acquired Customer (LTV):**

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Profit from a Widget	$6,500	0	0	0	0	$4,875
Profit from Maintenance	$637.5	$1,147.5	$1,032.75	$929.48	$836.40	$313.65
Sum of Profits	$7,137.50	$1,147.5	$1,032.75	$929.48	$836.40	$5,188.65
Cost of Capital Rate	0.50	0.50	0.50	0.50	0.50	0.50
Present Values of Profits	$(7137/1.5^0)$ = $7,137	$(1147.5/1.5^1)$ = $765	$(1032.75/1.5^2)$ = $459	$(929.48/1.5^3)$ = $275.4	$(836.4/1.5^4)$ = $165.24	$(5188.65/1.5^5)$ = $683.285
LTV	**$9485.425**					

Important Considerations

- The **business model decision** is very important
  - Your choice of business model can greatly impact your LTV
    - Recurring income:
      - Pros: can increase revenue
      - Cons: might necessitate additional capital from investors up-front (especially, if there are no up-front charges); hence, potentially increase cost of capital
    - One-time, up-front charge:
      - Pros: can reduce the amount of capital needed initially; hence, potentially decrease cost of capital
      - Cons: might not appeal to customers

Important Considerations

- LTV is about ***profit***, not ***revenue***
  - A common mistake among entrepreneurs is to tally up revenue (not profits) out of the business model channels
  - **Gross margin** and **cost of capital rate** are *integral* to determining an accurate LTV
- Gross margins make a big difference
  - Try to wrap your potentially lower-margin core product with high-margin add-on products, services, or upselling opportunities
    - (e.g., analytics reports, which might significantly appeal to customers!)
  - E.g., LARK Technologies started out with a **silent alarm clock**, which did not lead to **sustainable business** until they offered expert sleep analysis reports to end-users

Important Considerations

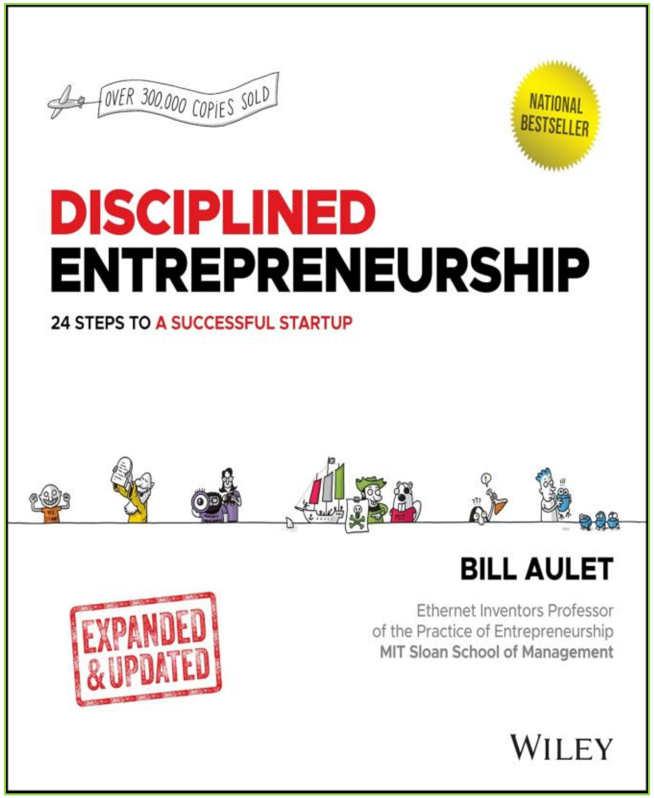
- **Retention rates** are critical as well
  - A small increase in your retention rate leads to a significant improvement in your cumulative profit
- Overhead costs are **NOT** negligible
  - To simplify LTV calculations, overhead costs (e.g., R&D and administrative expenses) **are excluded**
  - These costs might be high though!
  - Hence, LTV should be substantially larger than **CoCA** (Cost of Customer Acquisition)

Summary

- LTV is the profit that *a* (just 1, hence, **unit economics**) new customer will provide on average, discounted to the present value
- It is important to be *realistic*, NOT optimistic, when calculating LTV
- Try to understand the underlying drivers behind LTV so you can work towards increasing it
  - An ***LTV:COCA* ratio** of **3:1** or **higher** is what you shall aim for.

Reading

- Read **Step 17** of the "Disciplined Entrepreneurship" book
  - 2024 by Bill Aulet



Next Class

- **Calculate the Cost of Customer Acquisition (CoCA)**