TIM 105/205, LECTURE #18 (11/26/13)

1. NPV Basics

2. FMEA (failure modes ...)

3. Integration : MDC framework

4. Project
   - Project presentations on Tuesday, Dec. 3

5. Financial modeling details
   - Product Life Cycle
   - Technology Strategy (revisit)

6. Return, to you, graded HW #6

7. Team Project presentations
   - (5 + 1) minutes [NYC city]
   - Create (Title slide + 5 slides) in Power Point
   - Create a pdf of the PP presentation
   - e-mail the pdf to the TA
     no later than 5PM on Monday 12/2

NPV Basics

Key ideas :

1. It is important to understand and establish the cash-flows, present and future, associated with product development & commercialization
   - product dev. cost
   - production costs
   - . . . . .
   - Sales Revenue

2. All cash flows are converted to **present value**.

3. **Present value** : "A dollar today (present) is worth more than a dollar a year from today"

4. Therefore, all future cash flows have to be **discounted** when brought to the present

   ⟹ Discounted cash flows (DCFs)

5. The <u>N</u>et <u>P</u>resent <u>V</u>alue (NPV) is the sum of all of the DCFs

6. Calculation of <u>present</u> value:

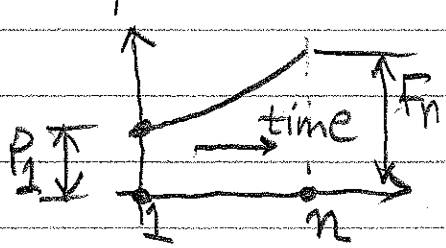
$P_1 \triangleq$ present value of cash (\$)

$1 \Rightarrow$ period 1 or the present

$F_n \triangleq$ future value of cash (\$) in period n

PV is simply the inverse of compound interest

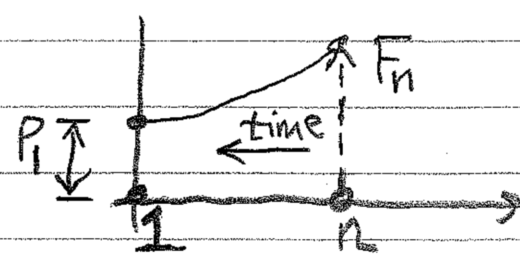
Compound Interest



$$F_n = P_1(1+r)^n$$

$r \triangleq$ interest rate per period

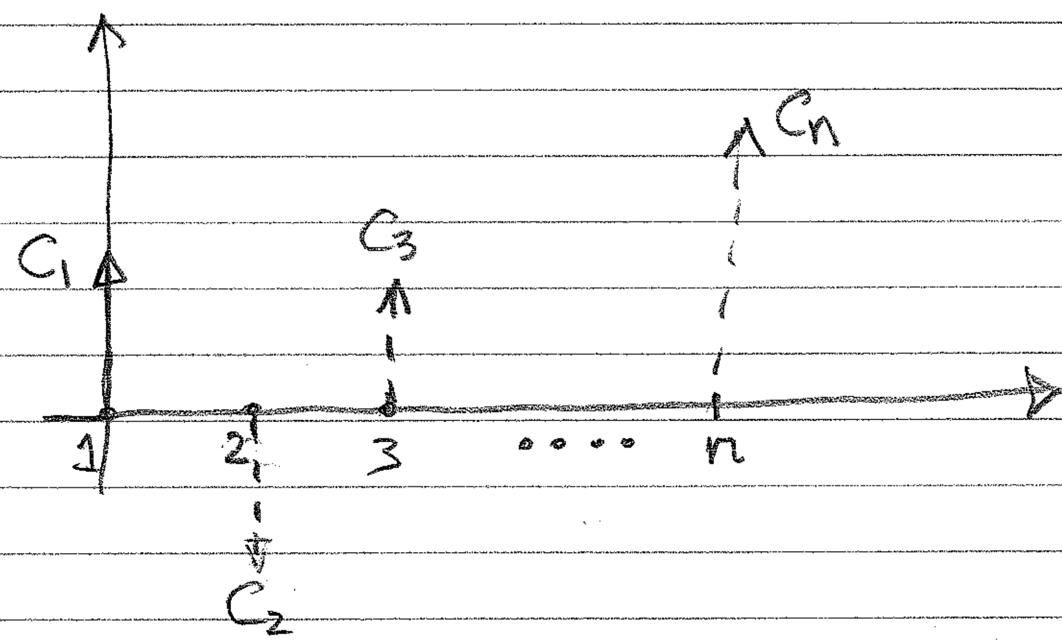
Present Value



$$P_1 = \frac{F_n}{(1+d)^n}$$

$d \triangleq$ discount factor per period

7. Net Present Value = $\sum$ DCFs



$$NPV = C_1 + \frac{C_2}{(1+d)^1} + \frac{C_3}{(1+d)^2} + \cdots \frac{C_n}{(1+d)^{n-}}$$

$$NPV = \sum_{i=1}^{n} \frac{C_i}{(1+d)^{i-1}}$$

C_i ← can be positive or negative

Failure Modes & Effects Analysis (FMEA)

Purpose: To improve the quality of the product by anticipating ways in which the product could fail & then either preventing or minimizing the effect of these failure modes before selling the product

Process:

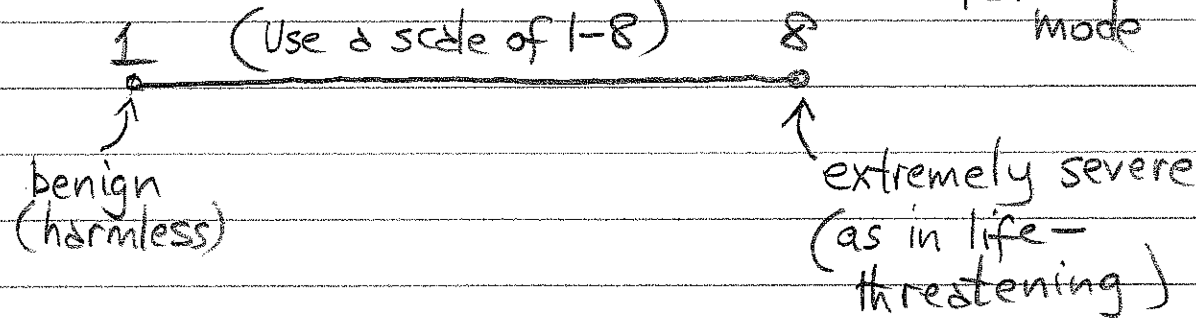
1. Create a FAST diagram for the product to
   - identify the key subsystems and components of the product
   - understand the key sub-functions of these sub-systems

2. For each sub-system identify potential failure modes, and characterize these failure modes using a Risk Priority Number (RPN) → see Step 3

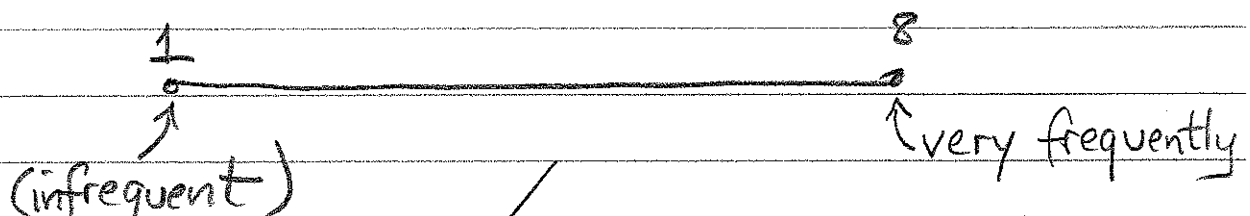
3. Calculation of the RPN

Ask (and answer) 3 questions

(a) How severe is the effect of the failure mode ⇒ severity S of the failure mode



(b) How frequently does this failure occur



O = frequency of occurence

(c) How hard is the failure to detect

$D \triangleq$ detection

1 (easy to detect) ———————— 8 (very hard to detect)

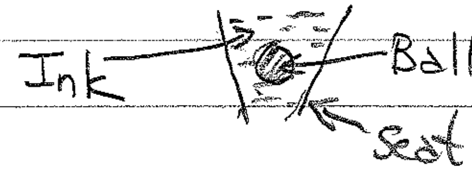
$$\underbrace{RPN}_{\text{risk priority number}} = \underbrace{(S) \times (O) \times (D)}_{1 \;\text{to}\; (8)^3 = 512}$$

The higher the RPN, the more critical the failure mode $\Rightarrow$ prescribe suitable actions

Guideline : RPN < 10 $\Rightarrow$ no action is required

Example : Ball-point pen

FAST diagram ←



↓

Sub-system	Failure-modes	Effects	S	O	D	RPN	Actions
Ball & Seat	Ball is too loose	splotchy writing	6	3	4	(6)(3)(4)	• In-proces inspections • ----
Ball & Seat	Ball is too tight	Inter-mittent writing	7	4	4	(7)(4)(4)	• In-process inspections • control tolerances of the ball & seat

Ref : FMEA handout on the TIM 105 web-site
- contains the Ball-point example worked out in detail

Exercise : Attempt to do an FMEA for your project

INTEGRATION

(of the course building blocks & the project "components")
→ e.g. strategy, functional maps, ... conceptual design

(1) Use the MDC framework

(2) Carefully study the interactions & inter-relationships between the steps of the MDC framework

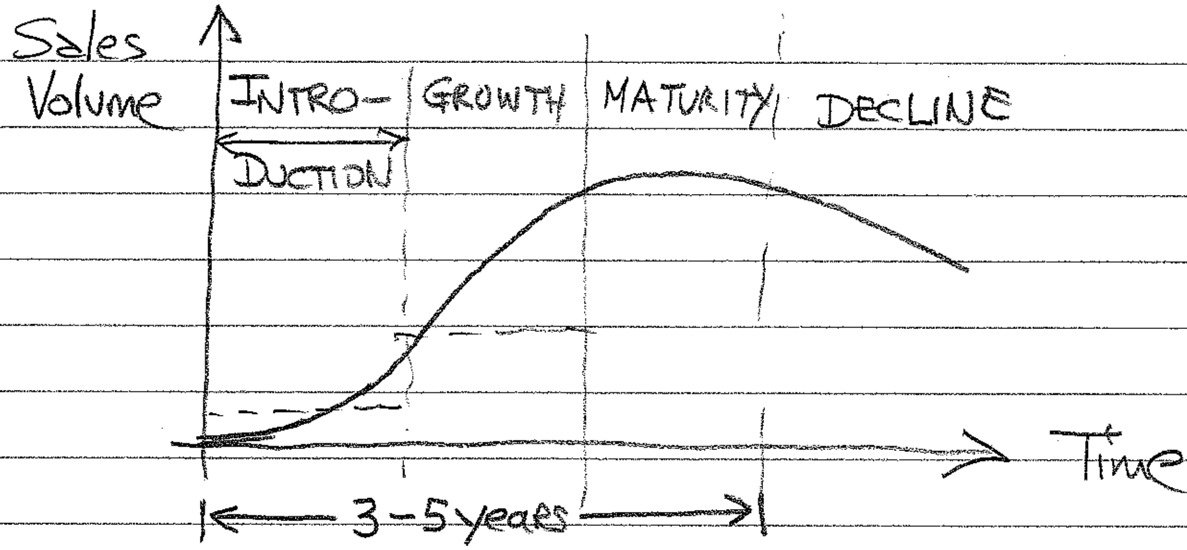
(3) In actual practice, many of these steps need to be done concurrently, i.e. in parallel

⇒ Concurrent Engineering (CE)

(4) The implement of CE in a computer is called Virtual Concurrent Engineering (VCE)

(5) Concurrent Engineering is typically performed by a cross-functional team
- Engineering
- Marketing
- Manufacturing
- Finance
⋮

Financial modeling



(a) **Product Life-Cycle**

- Take the product life-cycle into account in YOUR finance modeling/analysis

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(b) **Tech Strategy** (extended version) (TS

The full TS would contain

- (1) FOCUS ⟹ technology areas of distinct competitive advantage [core competencies]
- (2) SOURCE (where?) / RESOURCES
  - In-house [Internal]
  - Out-sourced [External]
- (3) TIMING (when)
  - when to develop the technologies, ...
  - → when the products will be introduced

[See the INTEL/Apple product platform]