- parameter ⇒ something which is certain.
- exogeneous variable ⇒ uncertain - source of risk

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SIMULATION

Theory → Imp : last classes. | Practical

Meaning of Simulation -

Creating replica of a real situation.

(Eg: Laksh movie - army training, mock trading, drills)

NPV = Cash Flow x PVAF (r,n) - Initial Investment

In simulation r = Rf not Kc ***

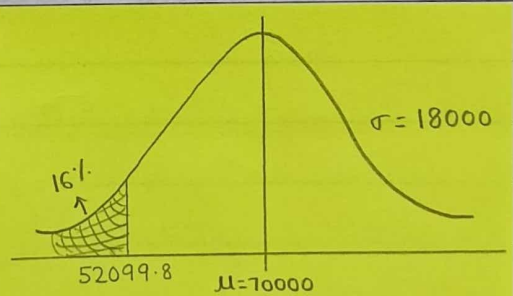
4 unknowns →
- CF → uncertain - exogeneous variable
- r = 5% → parameter (certain)
- n → uncertain - exogeneous variable
- I = 500000 → (certain)

'CF' aur 'n' k vjhse NPV certain nahi hai.

Hence Risk analysis.

Inter ka gyan - How to calculate CFAT.

Revenue	500000
(-) Variable Cost	200000
Contribution	300000
(-) Cash Fixed Cost	100000
EBDIT	200000
(-) Depreciation	50000
EBIT	150000
NOPAT (150000 x 70%)	105000
(+) Depreciation	50000
CFAT	155000



= RAND() → 0 to 1 - probability

= RANDBETWEEN (1,99)

= NORMINV (0.16, 70000, 18000)
= 52099.8

= NORMDIST (52099, 70000, 18000, true)
= 0.16

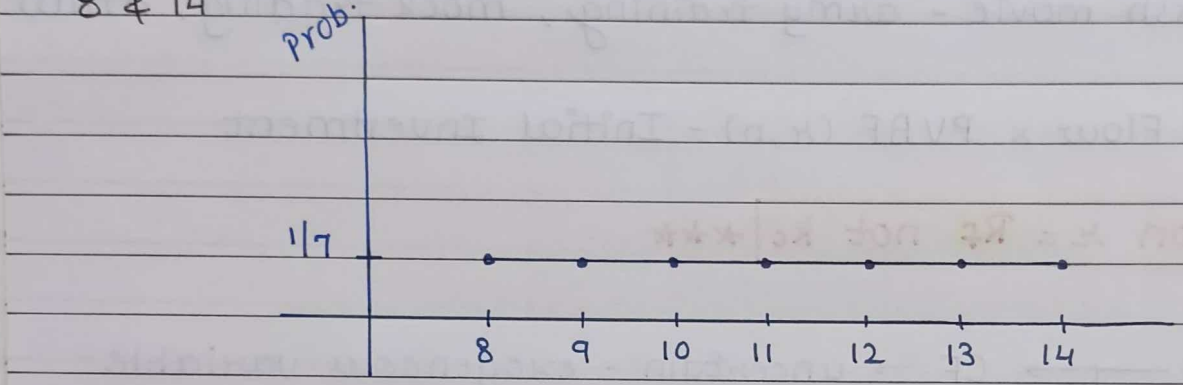
Assuming → CF = 52099 & n = 10

NPV = 52099 PVAF (5%., 10) − 500000 = −97705.33

Experienced Professional's se 'CF' & 'n' ka distribution mange. → CF ~ N (70000, 18000)

(CF follows normal distribution of mean = 70k & S.D. = 18000)

→ n ~ Discrete uniform distribution with 'n' lying between 8 & 14



Now we bring random i.e. luck factor.

Random numbers have no pattern.

Excel command → RAND() → value blw 0 & 1 (probability)

So, we use inverse function to generate values of 'CF' & 'n'

Excel command → NORMINV (rand(), 70000 (mean), 18000 (σ))

Similarly, we can generate values of 'n'

Now, Calculate NPV = CF × PVAF (5%., n) − I

↳ This called one run.

Repeat this process for say 10000 runs & you will get NPV distribution i.e. 10000 possible NPVs.

Calculate mean NPV & σ of NPV.

Self Note - Example of discrete distribution → Dice

probability of outcome = 1/6

Eg: Mean NPV = 40000, σ of NPV = 22000
Firm can tolerate max. CV of 40%.

Soln: Coef. of variation = $\frac{\sigma}{\text{mean}} = \frac{22000}{40000} = 55\% > 40\%$.

Since, C.V. exceeds maximum tolerable C.V, Reject.

Eg: Cash Flow

Exam focus

Value	Prob.	Cum. Prob.	Random No.
60000	0.3	0.3 (30)	0-29
90000	0.5	0.8 (80)	30-79
110000	0.2	1 (100)	80-99

Project Life = n

n	Prob.	Cum. Prob.	Random No.	Random No.
8	0.05	0.05	0-4	0-49
9	0.12	0.17	5-16	50-169
10	0.08	0.25	17-24	170-249
11	0.20	0.45	25-44	250-449
12	0.10	0.55	45-54	450-549
13	0.30	0.85	55-84	550-849
14	0.15	1	85-99	850-999

Q.1 / Pg

Step 1: NPV = CF x PVAF (r_f, n) - I
r_f = 7%
NPV = CF x PVAF (7%, n) - I

Step 2: Correspondence blw exogeneous variables and random numbers

Original Cost				Useful Life			
Value	Prob.	Cum. Prob.	Random No.	Period	Prob.	Cum. Prob.	Random No.
50000	0.4	0.4	0 - 39	4	0.3	0.3	0 - 29
60000	0.5	0.9	40 - 89	6	0.4	0.7	30 - 69
70000	0.1	1	90 - 99	8	0.3	1	70 - 99

Annual Net Cash Inflows			
Value	Prob.	Cum. Prob.	Random No.
12000	0.2	0.2	0 - 19
19000	0.2	0.4	20 - 39
25000	0.3	0.7	40 - 69
30000	0.3	1	70 - 100

Step3 : Calculation of NPV :

CF × PVAF(7%, n) − I ↓

Run	Original Cost		Useful life		Net cash inflow		NPV
	Rand. No.	Value	Rand. No.	Value	Rand. No.	Value	
1	53	60000	58	6	04	12000	-2801
2	30	50000	15	4	50	25000	34680
3	86	60000	20	4	80	30000	41616
4	62	60000	25	4	10	12000	-19353
5	11	50000	37	6	74	30000	92996

x	$(x-\bar{x})^2$
-2801	1038682657.96
34680	27587705.76
41616	148557094.56
-19353	2379546936.36
92996	4040941478.56
147138	$\sigma^2 = 7635315873.20$

$C.V = \frac{\sigma}{\bar{x}} \times 100$

$= \frac{39077.66}{29427.6}$

$= 132.79$

$\bar{x} = 147138/5 = 29427.6$

σ^2 = variance

Standard Deviation = σ

$= \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$

$= \sqrt{\frac{7635315873.2}{n}} = 39077.66$

∴ Why Rf not Kc ? → Only for simulation.
To avoid double counting of risk.

How come ?
Hum last me σ of NPV nikal rahe hai & usko dekh rahe hai nafrat ki nazorose.
That's fine .... we are fattu (Risk averse)
But if we already kc, we have already penalized the project bcoz - kc includes risk premium.....
then y would we again calculate σ of NPV !

Sum me Kc aur Rf dono diyeh to Rf we karo, even if σ is not asked in question..... Jada dimag mat chalao

Kc & Risk Prem. diye hai toh -
$Rf = \frac{1+Kc}{1+RP} - 1$ ← ✓
wrong → Rf = Kc - Risk Premium ✗

Note : Agar exam me, random no. ajib-o-garib aate hai like 57609, 92301, 56003, 89891 → then 1st 2 digits consider krk sum solve karna.
Q. 27 of iai.