ADVANCED CAPITAL BUDGETING DECISIONS

CLASS 1-HW-Q2

Topic Decision Tree

Question 2:

A heavy duty tilting machine is to be installed in Bhadra Coal Mines. Manager (Projects) of that mines is evaluating a land for its installation. He is considering two alternatives:

i. To conduct a soil test costing Rs.25,000 to find the nature of underlying soil and decide to install or not.

ii. To start installation on without any soil test.

The effect of installation can lead to three types of possible performances of the machine, during its operation

i. Good performance i.e., no breakdown or failure

ii. Moderate Performance i.e. frequent minor breakdowns but no major break downs, and

iii. Bad performance i.e., frequent major breakdowns.

If the machine is installed without conducting any soil test the probabilities of the performance of the machine is expected to be as follows:

Performance	Probability
Good	0.2
Moderate	0.3
Bad	0.5

If the manager conducts a soil test, the underlying soil in this case may be one of the following types: (i) Filled soil (ii) Soft soil (iii) Rock soil. Rock soil is best for installation of heavy machineries. The probabilities to find different types of soil are:

Type of Soil	Probability
Filled Soil	0.3
Soft Soil	0.4
Rock Soil	0.3

Probability of performance of the machine if installed in these soils are:

Type of Soil	Good	Moderate	Bad
Filled Soil	0.05	0.15	0.80
Soft Soil	0.30	0.40	0.30
Rock Soil	0.60	0.30	0.10

The present value of incomes associated with the performance of the machine are as follows:

Good	Rs.2,00,000
Moderate	Rs.80,000
Bad	–Rs.50,000

You are required to

a. Draw the Decision Tree Diagram.

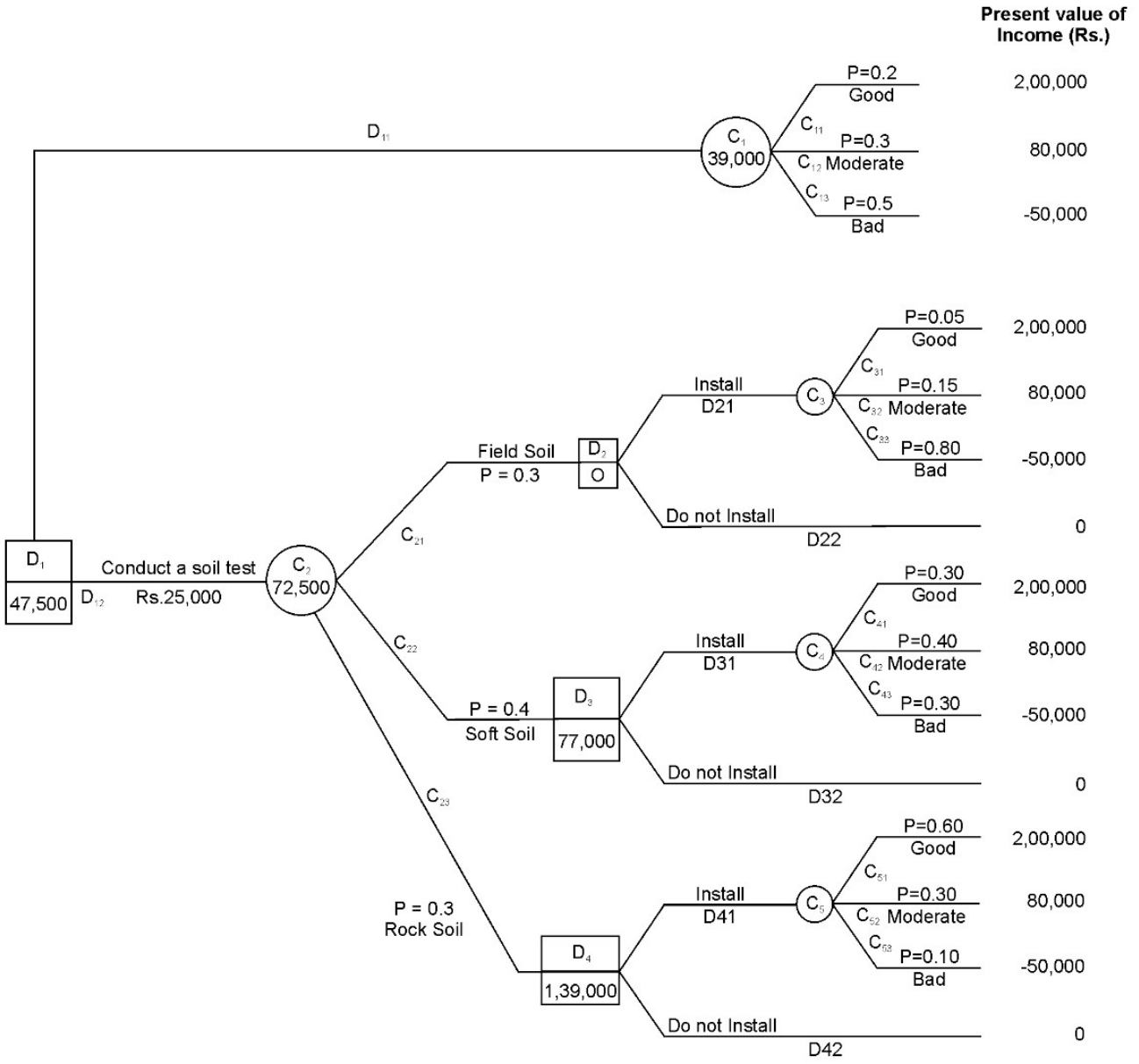
b. Find out the alternative which the manager (projects) should select.

c. Find out the mean and standard deviation of NPV for this alternative.

Solution In Reference Book

ANSWER:

a.



b. Expected PV at C_1, C_3, C_4 and C_5 are
EPV (C_1) = 39,000 EPV (C_3) = -18,000
EPV (C_4) = 77,000 EPV (C_5) = 1,39,000

Decision Point	Alternative	Expected PV	Expected PV of Selected Alternative
D_2	D_{21}	– 18,000	
	D_{22}	0	0
D_3	D_{31}	77,000	77,000
	D_{32}	0	
D_4	D_{41}	1,39,000	1,39,000
	D_{42}	0	

On the basis of the above information, the alternative selected at the decision points D_2, D_3 and D_4 are D_{22}, D_{31} and D_{41} respectively. The expected PV, assigned to D_2, D_3, D_4 are Rs.0, Rs.77,000 and Rs.1,39,000 respectively.

Now, expected PV at C_2 is 77,000 × 0.4 + 1,39,000 × 0.3 = Rs.72,500

Now lets see the expected PVs of different alternatives of decision point D_1.

Alternatives	Expected NPV (Rs.)
D_{11}	39,000
D_{12}	(72,500 – 25,000) = Rs.47,500

So, the best alternative for the company is D_{12} which says the company should go for a soil test before installing the machine.

c. Path, Probabilities and PV

Path	Probability (P_i)	NPV (N)
$D_{12} – C_{21} – D_{22}$	0.30	– 25,000
$D_{12} – C_{22} – D_{31} – C_{41}$	0.12	1,75,000
$D_{12} – C_{22} – D_{31} – C_{42}$	0.16	55,000
$D_{12} – C_{22} – D_{31} – C_{43}$	0.12	– 75,000
$D_{12} – C_{23} – D_{41} – C_{51}$	0.18	1,75,000
$D_{12} – C_{23} – D_{41} – C_{52}$	0.09	55,000
$D_{12} – C_{23} – D_{41} – C_{53}$	0.03	– 75,000

$$\overline{NPV} = \Sigma NP_i = \text{Rs.}47,500$$

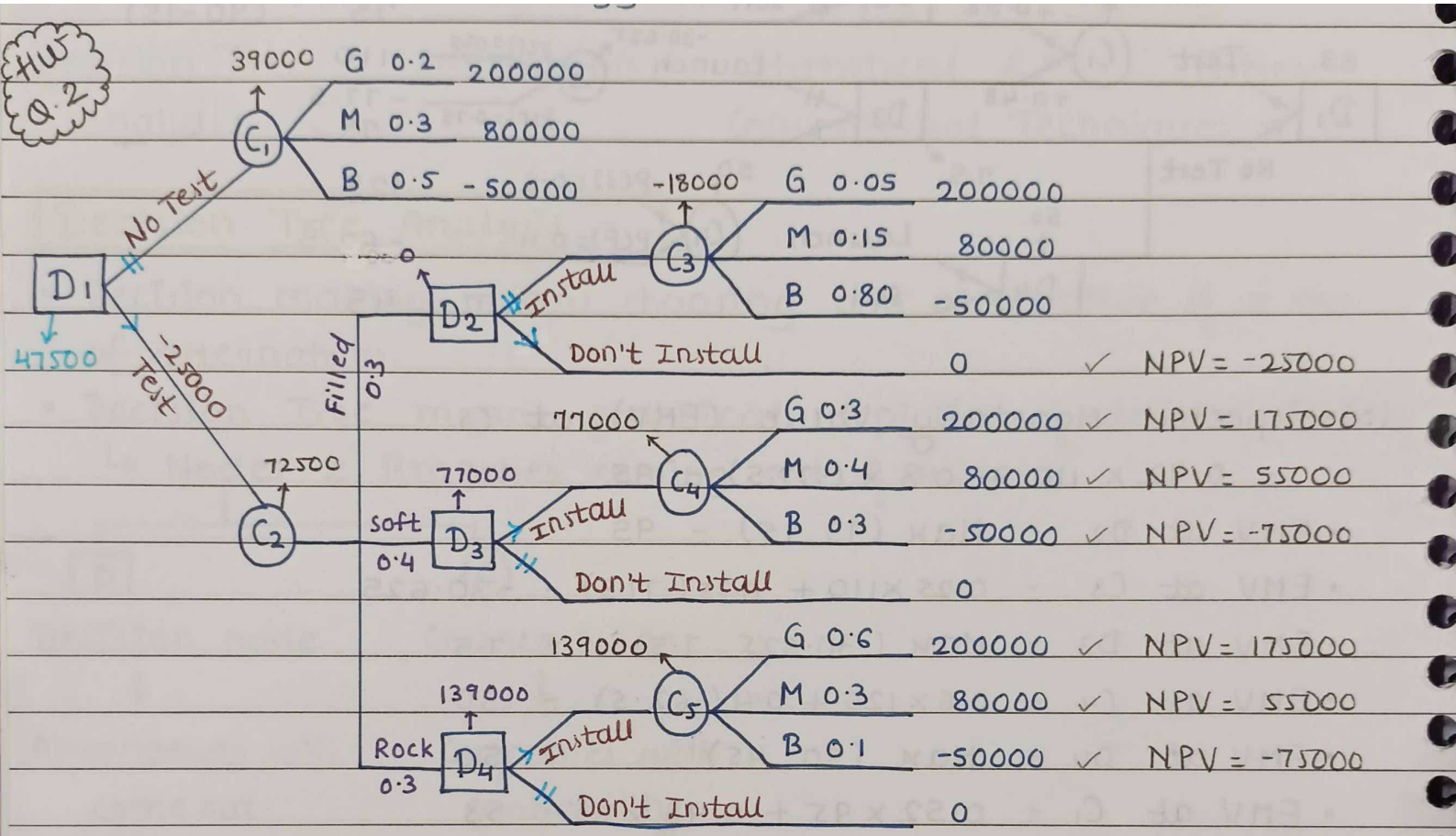
$$\sigma(NPV) = \{\Sigma(NPV - \overline{NPV})^2 P_i\}^{1/2}$$

$$= [(-25 - 47.5)^2 \times 0.3 + (175 - 47.5)^2 \times 0.12 + (55 - 47.5)^2 \times 0.16 + (-75 - 47.5)^2 \times 0.12 + (175 - 47.5)^2 \times 0.18 + (55 - 47.5)^2 \times 0.09 + (-75 - 47.5)^2 \times 0.03]^{1/2} \times 10^3$$

$$= (8718.75)^{1/2} \times 1000$$

$$= \text{Rs.}93374.25.$$

SOLUTION IN CLASS

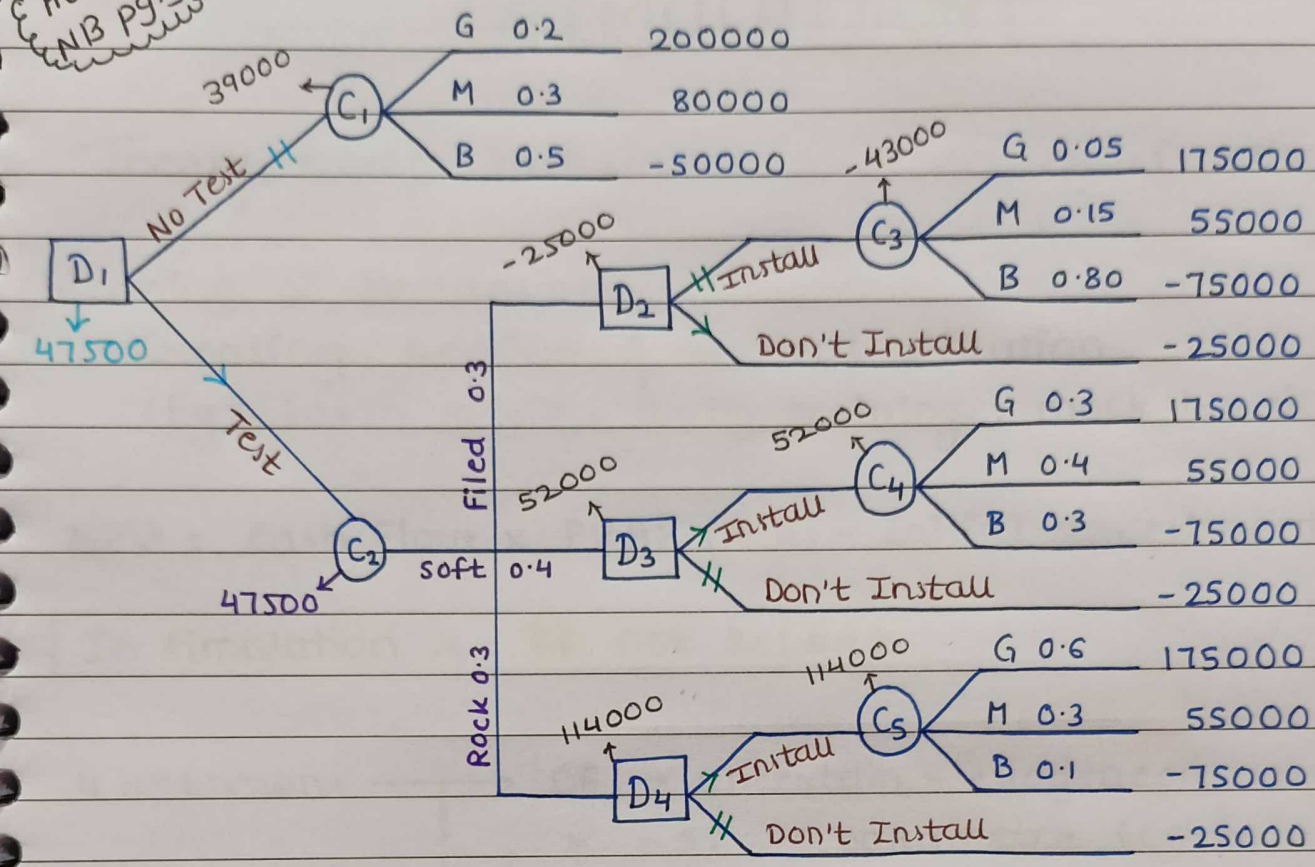


NPV (x)	Probability (p)	$\bar{x} = P(x)$	$P(x-\bar{x})^2$
-25000	0·3	-7500	1576875000
175000	0·4×0·3 + 0·3×0·6 = 0·3	52500	4876875000
55000	0·4×0·4 + 0·3×0·3 = 0·25	13750	14062500
-75000	0·4×0·3 + 0·3×0·1 = 0·15	-11250	2250937500
		47500	σ^2 = 8718750000

$\sigma = \sqrt{8718750000} = 93374.25$ $\quad \bar{x} = 47500$

HW: Q.2 NB Pg.3

Alternate solution :-



- At C_1, EMV = $200000 \times 0.2 + 80000 \times 0.3 + 0.5 \times (-50000)$
  $= 39000$

- At C_3, EMV = $175000 \times 0.05 + 55000 \times 0.15 + 0.80 \times (-75000)$
  $= -43000$
- At D_2, EMV = Max $(-43000, -25000) = -25000$

- At C_4, EMV = $175000 \times 0.3 + 55000 \times 0.4 + 0.3 \times (-75000)$
  $= 52000$
- At D_3, EMV = Max $(52000, -25000) = 52000$

- At C_5, EMV = $175000 \times 0.6 + 55000 \times 0.3 + 0.1 \times (-75000)$
  $= 114000$
- At D_4, EMV = Max $(114000, -25000) = 114000$

- At D_1, Max $(39000, 47500)$ $\therefore$ EMV = 47500