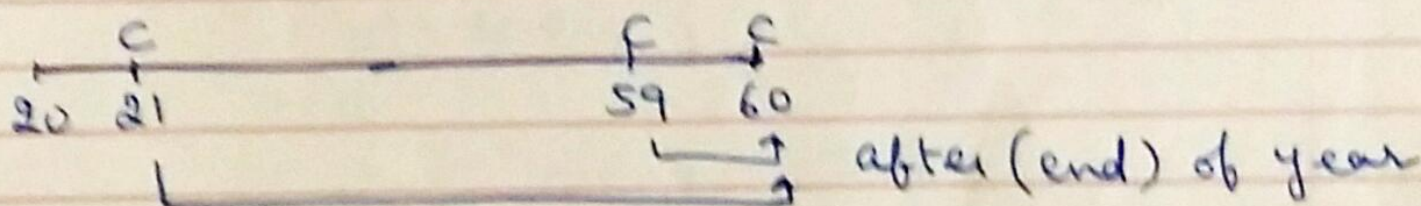


$$25000 + \frac{25000}{1.05} + \dots + \frac{25000}{(1.05)^{29}}$$

$$= 25000 \left(\frac{1 - \left(\frac{1}{1.05} \right)^{30}}{1 - \frac{1}{1.05}} \right)$$

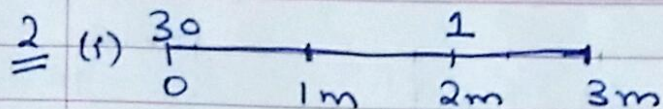
$$= 403526.84$$



$$C(1.06)^{40} + C(1.06)^{39} + \dots + C(1.06) + C$$

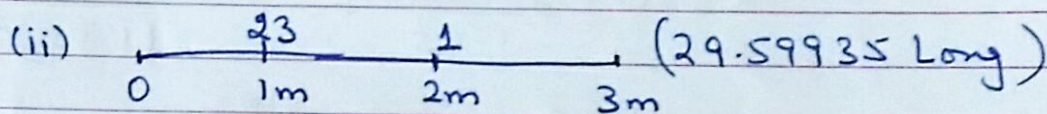
$$= C \left(\frac{(1.06)^{41} - 1}{1.06 - 1} \right) = 403526.84$$

$$\Rightarrow C = 2444.91$$



$$F = 30 e^{0.08 \times \frac{3}{12}} - 1 e^{\frac{0.08}{12}}$$

$$= 29.59935 \quad (\text{Long})$$



Price is fallen to 23 from 30
so forward will incur loss.

$$V_F = 23 - 29.59935 e^{-0.08 \times \frac{2}{12}}$$

$$- 1 \times e^{-0.08 \times \frac{1}{12}}$$

$$= -7.20$$

Or We compute forward (future value)

$$23 e^{0.08 \times \frac{2}{12}} - 1 e^{0.08/12}$$

$$= 22.302$$

\therefore loss

$$= -7.2973 \quad \text{at } t=3 \text{ month}$$

PV of loss (on 1 month)

$$= -7.2973 e^{-0.08 \times \frac{2}{12}}$$

$$= -7.20$$

(iii)

24	1.5	25	1	(24.59935 long)
0	1m	2m	2m	3m = 90 days
	= 30 day	day	60 days	

Recalculate forward (due to new dividend)

$$F = 30 e^{\frac{0.08}{4}} - 1 e^{\frac{0.08}{2}} - 1.5 e^{\frac{0.08 \times 3}{4}}$$

$$= 28.0792$$

	1.5	25	1	28.0792	<u>new F</u>
0	1m	2m	2m	3m	long

on 31st day value of forward

$$V = 25 - 28.0792 e^{-0.08 \times \frac{59}{360}} - 1 e^{-0.08 \times \frac{39}{360}}$$

$$= -3.7070$$

or Future value (forward with ^{2m} value = 25)

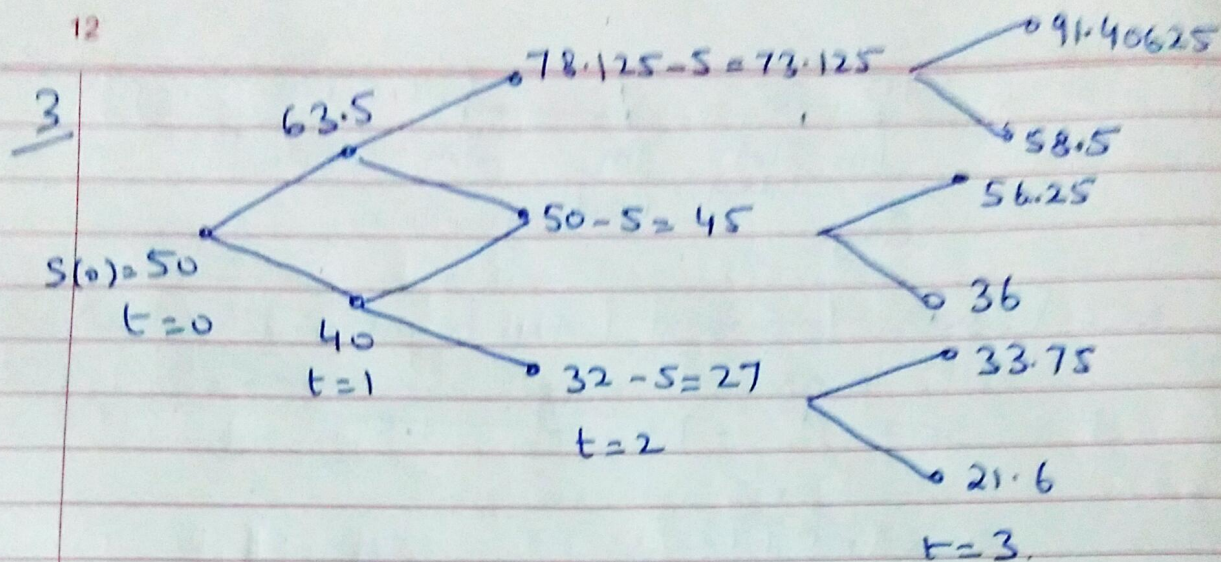
$$25 e^{0.08 \times \frac{59}{360}} - 1 e^{0.08 \times \frac{39}{360}}$$

$$= 24.32325$$

loss = -3.75595 on 90th day

$$\Rightarrow -3.75595 e^{-0.08 \times \frac{59}{360}}$$

$$= -3.7070 \text{ on 31st day}$$

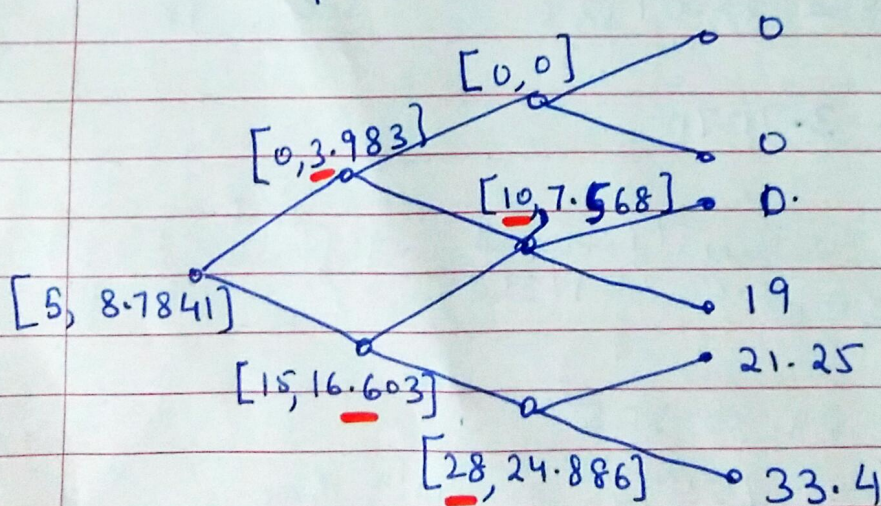


$$K = 55$$

$$\text{put payoff} = \max \{55 - S, 0\}$$

$$\hat{p} = \frac{1.06 - 0.8}{1.25 - 0.8} = 0.5778 ; R = 1.06$$

$$1 - \hat{p} = 0.4222$$



$$P^A(0) = 8.7841$$

where

$$[\xi, \eta] \text{ indicate } \begin{cases} \xi: \text{forward} = \max \{K - S, 0\} \\ \eta = \text{backward} \\ \eta = \frac{1}{R} [\hat{p} \text{ upper} + (1 - \hat{p}) \text{ lower}] \end{cases}$$

4

$$S(0) = 40, r = 0.06$$

Short 3 European Call $T=3, K=35$
 $C(0) = 6.13$

Received 18.39

Long 5 European Call $T=3, K=40$
 $C(0) = 2.78$

Paid 13.9

value of portfolio = 4.49 at $t=0$.

It will grow to $4.49 \times e^{\frac{0.06}{4}} = 4.581$
 after 3 months.

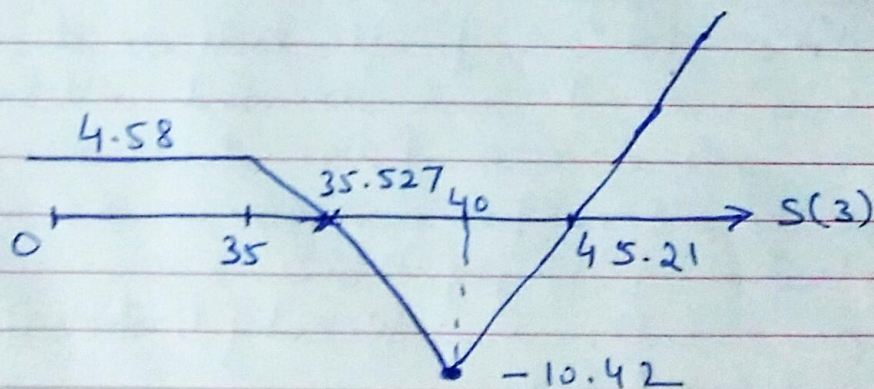
Let $S(3)$ be stock value at time 3 months
 Profit is

$$4.581 + 5 \max\{S(3) - 40, 0\} - 3 \max\{S(3) - 35, 0\}$$

(1) $S(3) < 35 \Rightarrow \text{Profit} = 4.581$

(2) $35 < S(3) < 40 \Rightarrow \text{Profit} = -3S(3) + 109.58$

(3) $S(3) > 40 \Rightarrow \text{Profit} = 2S(3) - 90.42$



Maximum loss = 10.42

Maximum profit unlimited.

$$40 \begin{cases} \uparrow 64 = 40 \times 1.6 = S_u \\ \downarrow 25 = 40(1 - 1.375) = S_d \end{cases}$$

$$C(0) \begin{cases} C_u = 24 \\ C_d = 0 \end{cases}$$

$$\hat{p} = \frac{1.06 - 0.625}{1.6 - 0.625} = 0.44615$$

$$1 - \hat{p} = 0.55385$$

$$C(0) = \frac{1}{1.06} (0.44615 \times 24) = 10.1015 \quad (\text{fair value})$$

Actual trade value of call = 11.50

\therefore Call is overpriced.

We can create arbitrage by buying low selling high.

① Selling high means sell this call at premium of 11.50. Lot of people will do it so supply of this call \uparrow and demand will be less. Bringing the call price down or in other words ~~stock price goes~~ we as writer needs to hedge by "buying low".

We create a replicating basket of stock & cash

$$xS + yA = C$$

$$\Rightarrow \left. \begin{array}{l} 64x + yA = 24 \\ 25x + yA = 0 \end{array} \right\} \Rightarrow x = \frac{24}{64 - 25} \approx 0.615385$$

1000 Calls (writer) receive buy 1000×0.615385
= 615.385 Stock

Cash position $\neq 0$

$$615.385 \times 40 - (1000 \times 11.5) = 13115.4$$

Strategy

At $T=0$, Borrow 13115.4 Cash for 1 period at 6%
Buy 615.385 Shares at 40
Sell 1000 Calls at 11.50

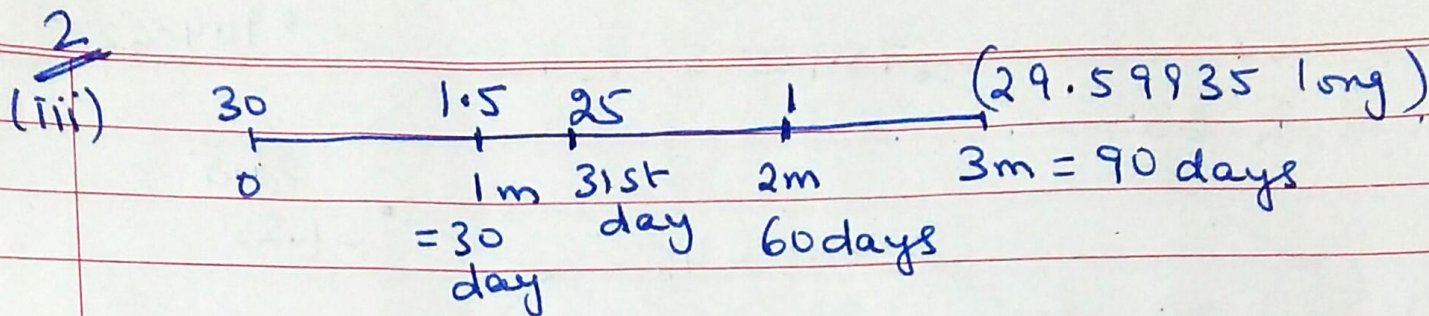
At $T=1$

Repay borrowed money = 13902.324
with interest

Sell the portfolio in 15384.6
Arbitrage \approx 1482.28

If $S \uparrow$ then $V(\text{Portfolio}) = 615.385 \times 64$
 $- 1000 \times 24 = 15384.64$

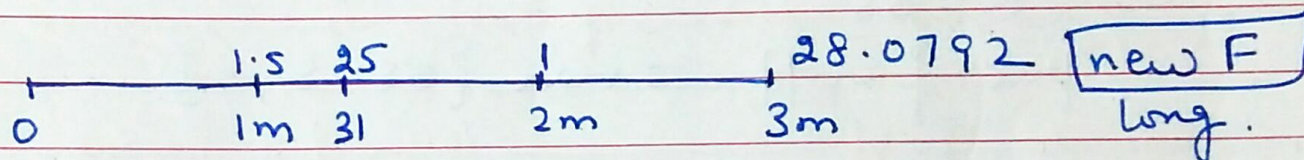
If $S \downarrow$ then $V(\text{Portfolio}) = 615.385 \times 25$
 $= 15384.625$



Recalculate forward (due to new dividend)

$$F = 30 e^{\frac{0.08}{4}} - 1 e^{\frac{0.08}{12}} - 1.5 e^{\frac{0.08 \times 2}{12}}$$

$$= 28.0792$$



on 31st day value of forward

$$V = 25 - 28.0792 e^{-0.08 \times \frac{59}{360}} - 1 e^{-0.08 \times \frac{29}{360}}$$

$$= -3.7070$$

or Future values (forward with ^{Stock} value = 25)

$$25 e^{0.08 \times \frac{59}{360}} - 1 e^{0.08 \times \frac{30}{360}}$$

$$= 24.32325$$

loss = -3.75595 on 90th day.

$$\Rightarrow -3.75595 e^{-0.08 \times \frac{59}{360}}$$

$$= -3.7070 \text{ on 31st day.}$$