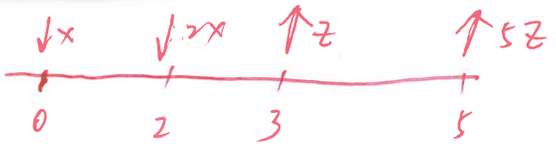
1. 

continuously compound r

(a) $NPV = -X - 2Xe^{-2r} + Ze^{-3r} + 5Ze^{-5r}$

(b) $FV_5 = -Xe^{5r} - 2Xe^{3r} + Ze^{2r} + 5Z$

(c) $FV_5 > 0 \Rightarrow -Xe^{5r} - 2Xe^{3r} + Ze^{2r} + 5Z > 0$

$$Z > \frac{Xe^{5r} + 2Xe^{3r}}{5 + e^{2r}}$$

500.

2. 

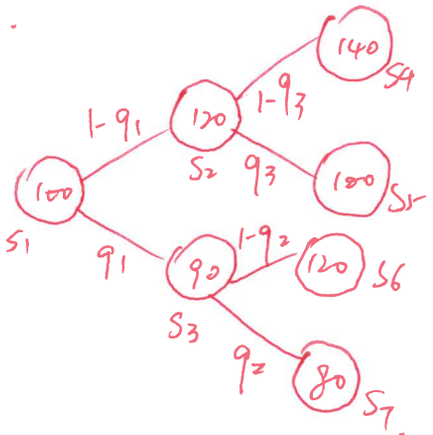
(a) $500 e^{r_1} e^{4r_2}$

(b) $e^{r_1} e^{4r_2} = e^{5r_{eff}}$

$$r_{eff} = \frac{r_1 + 4r_2}{5}$$

(c) $e^{r_1} e^{4r_2} = (1 + r_{eff})^5$

$$r_{eff} = e^{\frac{r_1 + 4r_2}{5}} - 1$$

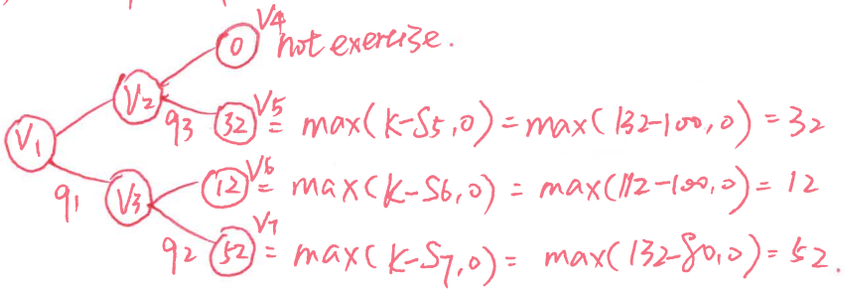
3. 

(a) risk-neutral $r = 0$.

$$q_1 = \frac{S_2 - S_1 e^{rot}}{S_2 - S_3} = \frac{120-100}{120-90} = \frac{2}{3} \qquad q_2 = \frac{S_6 - S_3 e^{rot}}{S_6 - S_7} = \frac{120-90}{120-80} = \frac{3}{4}$$

$$q_3 = \frac{S_4 - S_2 e^{rot}}{S_4 - S_5} = \frac{140-120}{140-100} = \frac{1}{2} \qquad 1-q_1 = \frac{1}{3} \quad 1-q_2 = \frac{1}{4} \quad 1-q_3 = \frac{1}{2}$$

(b) European put $K = 132$.



$$V_2 = e^{-r\Delta t}(q_3 V_5 + (1-q_3)V_4)$$

$$= e^{-0\times 1}\left(\tfrac{1}{2}\times 32 + 0\right) = 16$$

$$V_3 = e^{-r\Delta t}(q_2 V_7 + (1-q_2)V_6)$$

$$= e^{-0\times 1}\left(\tfrac{3}{4}\times 52 + \tfrac{1}{4}\times 12\right) = 42$$

$$V_1 = e^{-r\Delta t}(q_1 V_3 + (1-q_1)V_2)$$

$$= e^{-0\times 1}\left(\tfrac{2}{3}\times 42 + \tfrac{1}{3}\times 16\right) = \frac{100}{3}$$

(c) $$b = \frac{V_+ - V_-}{S_+ - S_-} = \frac{V_4 - V_5}{S_4 - S_5} = \frac{0-32}{140-100} = -\frac{4}{5}$$

buy $\frac{4}{5}$ shares ~~of stock~~ to hedge.