

$$a) \quad u = e^{\sigma \sqrt{\Delta t}}, \text{ where } \sigma = 0,25, \Delta t = 0,25$$

$$u = e^{0,25 \sqrt{0,25}} = 1,1331$$

The percent up movement is 13.31%

$$b) \quad d = \frac{1}{u} = \frac{1}{1,1331} = 0,8825$$

The percent down movement is  $1 - 0,8825 = 11,75\%$

$$c) \quad p = \frac{e^{r \Delta t} - d}{u - d} = \frac{e^{0,04 \cdot 0,25} - 0,8825}{1,1331 - 0,8825} = 0,51$$

$$d) \quad \text{down movement} : 1 - 0,51 = 0,49$$

call option

$$T_{uu} = \max(100 \cdot (1,13)^2 - 100, 0) = 29,75$$

$$T_{ud} = T_{du} = \max(100 \cdot 1,13 \cdot 0,88 - 100, 0) = 0$$

$$T_{dd} = \max(100 \cdot (0,8825)^2 - 100, 0) = 0$$

$$T = e^{-2 \cdot 0,04 \cdot 0,25} (0,51^2 \cdot 29,75 + 0 + 0) = 7,58$$

put option

$$T_{uu} = \max(100 - 100 \cdot (1,13)^2) = 0$$

$$T_{ud} = \max(100 - 100 \cdot 0,88 \cdot 1,13) = 10$$

$$T_{dd} = \max(100 - 100 \cdot (0,8825)^2) = 96,47$$

$$\text{value} = e^{-2 \cdot 0,04 \cdot 0,25} (0 + 10 \cdot 0,51 \cdot 0,49 + 96,47 \cdot (0,49)^2) = 14,54$$