(1). $S_0 = 1700$, $r = 1.5\%$, storage $= 1\%$

a) $F_{6\,months} = 1700 \cdot \exp[(0.015 + 0.01) \cdot 0.5] = 1721$

b) new $S_0 = 1700 + 170 = 1870$

$F_{3\,month} = 1870 \cdot \exp[(0.015 + 0.01) \cdot 0.25] = 1882$

Value of the f.c. in a): $(1882 - 1721)\, e^{-0.015 \cdot 0.25} = \underline{\underline{159.35}}$

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(2). $S_0 = 1.31$, $r_f = 2\%$, $r_d = 1.5\%$

a) $F_6 = 1.31 \cdot e^{(0.02 - 0.015) \cdot 0.5} = 1.3133$

Price of f.c. for 1M USD $= \frac{1M}{1.3133} = 761.5$ K€

b) new $S_0 = 1.2445$.

$F_3 = 1.2445 \cdot e^{(0.02 - 0.015) \cdot 0.25} = 1.2461$

$F_5 = 1.2445 \cdot e^{(0.02 - 0.015) \cdot 5/12} = 1.2471$

5-months forward price for 1M USD $= \frac{1M}{1.2471} = 801.9$ K€

Value of the contract in a): $(801.9 - 761.5)\, e^{-0.015 \cdot 5/12} = \underline{\underline{40.11 \text{ K€}}}$

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(3). $c = 3$, $S_0 = 47$, $K = 50$, $r = 3\%$, $T = 1/12$

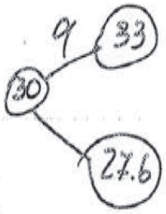
$$p = c + Ke^{-rT} - S_0 = 3 + 50e^{-0.03 \cdot \frac{1}{12}} - 47 = \underline{\underline{5.875}}$$

Given: $p = 6.3 \Rightarrow$ arbitrage opportunity

Sell put, go short 1 stock, buy call,
invest the rest at risk free rate.
After one month, realize profit of $\underline{6.3 - 5.875}$.

payoff call

(4).



3

0

$K = 30$
$r = 4\%$

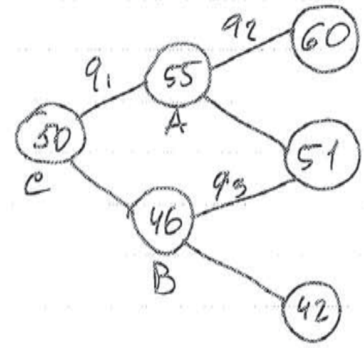
$$q = \frac{S_0 e^{rT} - S_d}{S_u - S_d} = \frac{30.3 - 27.6}{33 - 27.6} = \underline{\underline{0.5}}$$

Call price:

$$c = 3 \cdot 0.5 \cdot e^{-0.01} = 1,485$$

$$\Delta = \frac{3}{33 - 27.6} = 0.556$$

5



ATM put	ATM call	digital call
0	10	1
0	1	1
8	0	0

$$q_1 = \frac{50-46}{55-46} = \frac{4}{9} = q_2 = q_3$$

$$\text{price (put)} = \frac{5}{9}\cdot\frac{5}{9}\cdot 8 = 2.47$$

$$\text{price (call)} = \frac{4}{9}\cdot\frac{4}{9}\cdot 10 + 2\cdot\frac{4}{9}\cdot\frac{5}{9}\cdot 1 = 2.47$$

$$\text{price (dig.call)} = \frac{4}{9}\cdot\frac{4}{9} + 2\cdot\frac{4}{9}\cdot\frac{5}{9} = 0.69$$

~~Answer~~ Deltas:

put: $\Delta_A = 0, \quad \Delta_B = \frac{0-8}{51-42} = -\frac{8}{9}$

$\text{Value}_A = 0, \quad \text{Value}_B = \frac{5}{9}\cdot 8 = 4.44$

$\Delta_C = \frac{0-4.44}{55-46} = -0.49$. American put $\equiv$ European

5 cont. call: $\Delta_A = 1, \quad \Delta_B = \frac{1-0}{9} = \frac{1}{9}$

$\text{Value}_A = 5, \quad \text{Value}_B = \frac{4}{9}, \quad \Delta_C = \frac{5-4/9}{9} = \underline{\underline{0.506}}$

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6 European call, $T = \frac{1}{2}$, $S_0 = 47$, $X = 50$, $r = 3\%$, $\sigma = 30\%$

$C_{BS} = 3.036 \quad ; \quad \Delta = N(d_1) = 0.454$