5.1 present value for the Return is

ⓐ $K=100$. then return is 10.

$$\frac{10}{e^{0.06*2}} - 10 = -1.1308$$

ⓑ

$$\frac{0}{e^{0.06*2}} - 10 = -10.$$

5.2. ⓐ $\underline{0} - 5 = -5$

ⓑ

$$\frac{2}{e^{0.06*\frac{1}{2}}} - 5 = -3.059$$

5.3. Consider the law of One Price.

Plan I : purchase an option at time 0 and buy @ price K at time 1

Plan II : buy security at time 0 at Price S.

Plan I, II generate the same result : $\boxed{\text{at time 1, 1 share of stock}}$

the cost of Plan I: $\frac{K}{e^r} - C$

the cost of Plan II : S.

$$\Rightarrow \frac{K}{e^r} - C = S \Rightarrow C = S - Ke^{-r}$$

If $c > S$

then ~~buy~~ the stock, sell call at $t=0$

~~One~~ will get $c-S$

at $t=1$. if the price is higher than K, ~~call option~~

we can simply give the owner the stock

if the price is lower than K. it is worthless

In all cases. Arbitrage is $c-S$

5.5 $S+p-c=Ke^{-rt}$

$p>0 \Rightarrow \boxed{Ke^{-rt} > S-c}$

5.6. $S+p-c=Ke^{-rt} \Rightarrow c=S+p-Ke^{-rt}$

$\Rightarrow c > S-Ke^{-rt} = 50-28e^{-0.05 \times \frac{6}{12}}$

5.7 ~~ⓐ $S+p-c=Ke^{-rt}$ $p=Ke^{-rt}+c-S$~~

5.8 $S+P-C=Ke^{-rt}$

$$P = Ke^{-rt} - S + C$$

$\Rightarrow P \geq Ke^{-rt} - S$ because $C \geq 0$

5.9 at $t=0$ sell stock get S

sell one put get P so initially get $S+P-C$

buy call pay C

put into bank.

at $t=t$. If $S(t) > K$ put 0

call $\boxed{\text{pay } K}$ buy stock and return to market

If $S(t) < K$ put pay K to option holder buy stock and return marke-

~~call~~

call 0.

i.e. we always pay K

$$\text{Gain} = (S+P-C)e^{rt} - K > 0$$

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5.10. Want to show $S+p-c=ke^{-rt}$

Plan I : t=0 buy S. ~~buy~~ buy P. sell C

initial cost is $S+p-C$

~~did~~ t=t, always get K ~~at t=0~~

Plan II : put ke^{-rt} into bank.

cost of Plan 1 $S+p-C$

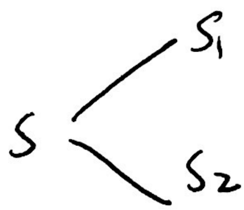
payoff of Plan 1 : get K

cost of Plan 2 : ke^{-rt}

payoff of Plan 2 = K.

$\Rightarrow S+p-c=ke^{-rt}$

5.11.



ⓐ Suppose p is the Price of Put

at t=0 we pay p and S to the put option and security

at t=0 due to $K>S_1>S_2$ we will sell it at K

so return is $K-(p-S)e^{rt}$

ⓑ $K-(p-s)e^{rt}=0 \Rightarrow p=ke^{-rt}-S$.

5.12 Plan I : put e^{-rt} into bank @ $t=0$

we will have 1 @ $t=1$

Plan II : buy put, buy call, we pay C_1+C_2 @ $t=0$

we will have 1 @ $t=1$

so. $C_1+C_2=e^{-rt}$

5.13. $25=S+P-C > Ke^{-rt}=20e^{-\frac{0.1}{4}}$

then we sell the security short — get S

at $t=0$ sell the put — get P

buy the call — pay C

$\left.\begin{matrix} \text{get } S \\ \text{get } P \\ \text{pay } C \end{matrix}\right\}$ $S+P-C$ into bank

at $t=t$ $S(t)>K$ put: 0; call: realize it, get K; security: return to market

$S(t)<K$. put: will be realized by owner, we get K; call: 0; security: return to market

then gain $=(S+P+C)e^{rt}-K$

5.14 put call parity formula is for European style.

let they are C and P

then $C_a = C$ $\quad P_a \geq P$

$$S + P - C \geq ke^{-rt}$$

then $S + P_a - C_a \geq ke^{-rt}$

$\underline{K_2 - K_1 + P_1 - P_2 > 0}$

We want to show arbitrage.

5.15 Suppose ~~If~~ $(K_1 - K_2 < P_1 - P_2)$ $\wedge$ Suppose $P_1 > P_2$

then ~~well~~ we will sell $\binom{K_1}{P_1}$, buy $\binom{K_2}{P_2}$

when at t=0 ~~return~~ we pay P_2 but get $P_1 \Rightarrow$ then get $P_1 - P_2$

at $t=t$ if one exercise the $\binom{K_1}{P_1}$, then we will exercise $\binom{K_2}{P_2}$

that will give us $K_2 - K_1$

then $\cancel{P_1 - P_2 - (K_2 - K_1)}$ is the arbitrage

$$(K_2 - K_1) - (P_1 - P_2) = K_2 - K_1 - P_1 + P_2 > 0$$

so $K_1 - K_2 < P_1 - P_2$ is wrong

then $K_1 - K_2 \geq P_1 - P_2$ is correct

5.16. P_1 $\quad t \quad \to$ Put option I

P_2 $\quad s. \quad \to$ Put option II

show : $s < t$, then $P_1 \geq P_2$

Pf : If $P_1 < P_2$, we will have arbitrage :

we buy $\binom{P_1}{t}$ sell $\binom{P_2}{s}$

due to $s < t$, then : if the owner of $\binom{P_2}{s}$ will exercise the put, then we will exercise our holding $\binom{P_1}{t}$

then the transactions cancel each other.

then $P_2 - P_1$ is the arbitrage

so $P_2 - P_1 \leq 0 \Rightarrow P_2 \leq P_1$