Problem Set 3

 # 1: Suppose company A stock is trading for \$80/share on the NYSE but is also trading on the OTC markets for \$72/share. What steps could you take to take advantage of this?

 # 2: Consider a 1 period model with 2 states of the world at time 1. We have 3 stocks, A,B, and C with prices at time 0

$$\begin{aligned} P_A(0) &= \$100 \\ P_B(0) &= \$50 \\ P_C(0) &= \$220 \end{aligned}$$

and prices in the the two states of the world

		State I	State II
$P_A(1)$	=	\$60	\$250
$P_B(1)$	=	\$80	\$40
$P_C(1)$	=	\$200	\$540

Find an arbitrage portfolio involving these stocks.

 # 3: Suppose the spot (current market) price for Brent crude oil is \$64/barrel. Suppose the current 1 year forward price for Brent crude is \$67/barrel, i.e. it is possible now to enter a contract (without payment) to sell or buy Brent crude in 1 year at a price of \$67/barrel. Suppose the current risk free, continuously compounded, interest rate for a 1 year term is $r = 3\%$. Is there an arbitrage opportunity? Ignore any storage costs or convenience yields.

Hint: What happens if you borrow \$64 at the risk free rate, buy a barrel of oil, and enter this forward contract as seller of oil?

 # 4: Consider a 1 period model with 3 states of the world at time 1 and 4 assets with prices at time 0

$$
\begin{aligned}
P_A(0) &= \$15 \\
P_B(0) &= \$10 \\
P_C(0) &= \$14 \\
P_D(0) &= \$10
\end{aligned}
$$

and prices at time 1 in the the three states of the world

		State I	State II	State III
$P_A(1)$	=	\$20	\$10	\$40
$P_B(1)$	=	\$20	\$12	\$8
$P_C(1)$	=	\$20	\$38	\$12
$P_D(1)$	=	\$12	\$12	\$12

Find an arbitrage portfolio involving these assets.

 # 5: Justify the 2 extended versions of the Law of One Price stated in the lecture. We recall these extensions here.

Law of One Price Extension #1: *If two securities, with certainty, pay the exact same cash flows then they should have the same price at any time during their lives.*

Hint: Try applying the Law of One Price to each individual cash flow.

Law of One Price Extension #2: *If A and B are 2 assets with prices $P_A(t)$ and $P_B(t)$ and if at some time $T > 0$ we can say*

$$P_A(T) \geq P_B(T)$$

with probability 1, then we must have

$$P_A(0) \geq P_B(0)$$

Hint: Proceed with the same argument used for the original version of the Law of One Price. Assume that instead

$$P_A(0) < P_B(0)$$

You can then construct an arbitrage portfolio by shorting B and taking a long position in A.