Final Exam Solutions

1a. $EAR = (1+\frac{0.04}{2})^2 - 1 = 0.0404$

$$\Rightarrow PV(\text{maintenance}) = \frac{500}{0.0404-0.02}\left(1-\left(\frac{1.02}{1.0404}\right)^{25}\right)\cdot\frac{1}{1.0404^4} = 8168.1$$

$\Rightarrow$ maximum purchase price $= 25000 - 8168.18 = 16831.82$

1b. Bond is at par which means the bond price today is \$1000. Since you have \$25,000 to invest, you'll buy 25 bonds.

$$\text{Bond price in 2yrs} = \frac{80}{0.06}\left(1-\frac{1}{1.06^8}\right) + \frac{1000}{1.06^8}$$

$$= 1124.20$$

$$\Rightarrow \text{maximum purchase price in 2yrs} = 25\left(\underbrace{80\times 1.06}_{\text{first coupon}} + \underbrace{80}_{\text{2nd coupon}} + \underbrace{1124.20}_{\text{selling price}}\right)$$

$$= 32224.90$$

2a- Both portfolios have the same expected return. According to the Markowitz's model we choose the portfolio with the smallest variance.

$$\left.\begin{aligned}\sigma_1^2 &= (0.2)^2(0.1)^2 + (0.6)^2(0.2)^2 = 0.0148\\ \sigma_2^2 &= (0.6)^2(0.1)^2 + (0.2)^2(0.2)^2 = 0.0052\end{aligned}\right\}\text{ Choose portfolio 2.}$$

2b- $w_m = \frac{1500}{1000} = 1.5 \Rightarrow \beta_p = w_m = 1.5$ (w_m is the weight on the market portfolio)

2c- $$\frac{\text{Unsystematic risk of } A}{\text{Variance of } A} = \frac{\frac{1}{2}\sigma_m^2 - \beta_A^2\sigma_m^2}{\frac{1}{2}\sigma_m^2}$$

But: $\beta_A = \frac{\bar{r}_A - r_0}{\bar{r}_M - r_0} = \frac{1}{2} \Rightarrow \frac{\text{Unsys } A}{\text{Variance } A} = \frac{\frac{1}{2}-\frac{1}{4}}{\frac{1}{2}} = 50\%.$

2d-

(i) P1 & P2 are efficient & $SD(1) > SD(2)$ implies $\beta_1 > \beta_2$ but $\beta_1 = 0.6 < 0.8 = \beta_2$.

(ii) P1 is given to be efficient but P3 has a higher expected return and a lower SD than P1 has.

(iii) $\bar{r}_1 < \bar{r}_2$ but $\beta_1 > \beta_2$.

3a- 300 → $300 \times 1.25 = 375$

300 → $300 / 1.25 = 240$

3b- Maximum option payoff:

C_0 → $\max(\text{put}, \text{call}) = \max(25, 75) = 75 = C_u$

C_0 → $\max(\text{put}, \text{call}) = \max(160, 0) = 160 = C_d$

=> Replicating pf is: Invest $x = \dfrac{C_u - C_d}{u - d} = -188.89$ in the stock (i.e., short the stock) and invest $y = \dfrac{C_u - ux}{R_0} = 309.04$ in the risk-free security (i.e., deposit money).

3c. Option price $= x + y = 120.15$

4a. The incremental cost for the building is the \$1 million rent because if the project is accepted, then the firm will have to pay an extra \$1 million.

We first calculate f_A: $\begin{cases} D = 10{,}000 \times 1{,}000 = 10{,}000{,}000 \\ E = 150{,}000 \times 75 = 11{,}250{,}000 \end{cases}$

$\Rightarrow w_E = 0.529412$ & $w_D = 0.470588$

$\Rightarrow f_A = w_E \times 0.09 + w_D \times 0.04 = 0.066471$

No flotation costs are paid on NWC since the company doesn't use outside funds for NWC.

$$\Rightarrow \text{Initial } cf = -500{,}000 - \frac{31{,}000{,}000}{1-f_A} = -33{,}707{,}309.39$$

4b. $6{,}500{,}000 - 0.35(6{,}500{,}000 - 0) = 4{,}225{,}000$

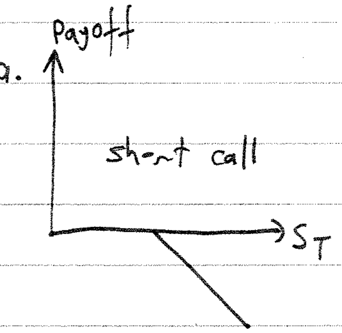
4c. $r_D = YTM = 7\%$ and $r_E = 0.05 + 1.5(0.08 - 0.05) = 9.5\%$.

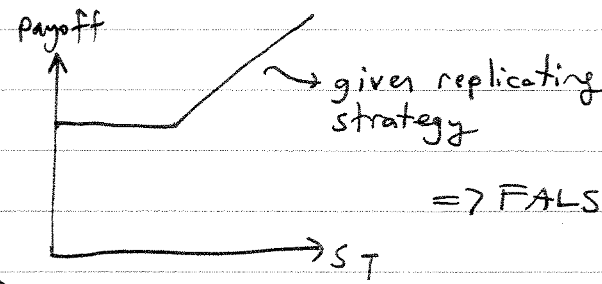
$$\Rightarrow WACC = 0.07 \times w_D \times (1 - \tau_c) + 0.095 \times w_E$$
$$= 0.07170588 \equiv r$$

4d.

$$NPV = -33{,}707{,}309.39 + \frac{4{,}500{,}000}{r}\left(1 - \frac{1}{(1+r)^{10}}\right)$$
$$+ \frac{4{,}225{,}000}{(1+r)^{10}} + \frac{500{,}000}{(1+r)^{10}} = 15067.3970 \Rightarrow \text{accept.}$$

5a.





$\Rightarrow$ FALSE.

5b. Beta $= b \Rightarrow \bar{r}_p = \overbrace{r_0 + b(\bar{r}_m - r_0)}^{\hat{r}}$ by CAPM. Thus, we are minimizing stdev such that portfolio expected return $= \hat{r}$. Note that this is the Markowitz's mean-var problem. Therefore the portfolio is efficient $\Rightarrow$ TRUE.

5c. We have $E = S_0(1+r)^T$. By put-call parity:

$$C = S_0 + P - E/(1+r)^T = S_0 + P - \frac{S_0(1+r)^T}{(1+r)^T} = P \Rightarrow \text{FALSE.}$$

5d.

		$S_T > E$	$S_T \le E$
Strategy 1:	$\max(E - S_T, 0) + S_T =$	S_T	E
Strategy 2:	$\max(S_T - E, 0) + E =$	S_T	E

$\Rightarrow$ TRUE.