Q4 (a) Show how to create a portfolio of stocks and gold that has zero risk

Zero risk means whether the economy will boom or recession. The portfolio will give the same return. We have following 2 equations to solve simultaneously.

So

Hence, we spend 40% money on stock, 60% on gold, it will give us 2% profit in both boom or recession situation.

(b) Suppose that risk-free Treasury bills have a return of 4%. In light of results in a) is there  
any interesting investment opportunity here? If yes, please describe in detail the possible investment strategy and how it would make you a happy investor

You can short sell your portfolio at 2% and invest on T-bill at 4%. It will let you make 2% difference, hedge.

Q5 Assume that you manage a risky portfolio with an expected rate of return of 17% and a  
volatility of 27%. The T-bill rate is 7%. Suppose your client initially chooses to invest  
70% of a portfolio in your fund and 30% in T-bill.

1. What is the expected return and volatility of your client's portfolio?
2. Now, suppose that your client wonders whether to switch the 70% that is invested in your fund to the passive portfolio with the expected return of 13% and a volatility of  
   25%. Explain to your client the disadvantage of the switch

Switch to another portfolio will **decrease the sharp ratio**, and he need to pay commission fee.

1. Show your client the maximum fee you could charge (as percent of the investment in  
   your fund deducted at the end of the year) that would still leave him at least as well  
   off investing in your fund as in the passive one.

Charge x% fee.

Same sharp ratio.

**Hence** I can charge 3.52% fee and the remaining money for him is still same if he switch to passive one.