

**THE AUSTRALIAN NATIONAL UNIVERSITY
RESEARCH SCHOOL OF FINANCE, ACTUARIAL STUDIES
AND STATISTICS**

**FINANCIAL MATHEMATICS (STAT2032 / STAT6046)
SEMESTER 1, 2017**

ASSIGNMENT

Due Date: Friday 19 May 2017 by 4 PM

Total Marks = 30

Instructions

- All students must submit an assignment of their individual own work.
- Submission method: **Hardcopy** assignment submission. All assignments must be submitted to the assignment box outside the School Office on level 4 of the CBE building 26C and must include a **cover sheet**. The assignment cover sheet can be found on Wattle.
- You are encouraged (optional) to use EXCEL to help you complete the assignment and submit your EXCEL Spreadsheet on Wattle. However, the Excel spreadsheet will NOT be marked.
- Only your hardcopy assignment will be marked. So you should provide detailed steps and relevant processes for each question. Only a numerical answer would NOT be accepted.
- Please keep a copy of the assignment for your record.

Assume you just graduated from the ANU and received a job offer. You start working on your new job today (1/1/2018). You plan to purchase your first home with a home loan several years after your graduation when financially possible.

1. Assume the current property price is \$600,000 and the market price will increase at a rate of 5% p.a. This increase is processed on a yearly basis and the property price will remain constant throughout the year. For example, the property price will be \$600,000 in year 2018, $\$600,000 \times (1+5\%)$ in year 2019, and so on. According to the home loan that you would like to apply for, the initial principal you have to repay is 20% of the property price, which is called the downpayment. The remaining principal will be repaid via an amortization method at the nominal interest rate 4.5% p.a. compounded monthly.
2. Assume your initial salary is \$5000 and your salary is to increase at a rate of 4% p.a. This increase is processed on a yearly basis, with the next increase to occur after 12 further salary payments at the recently increased rate.
3. Assume your living expenses will be \$2500 per month and will increase by 0.2% per month. The expense at the end of the 1st month will be \$2500.
4. Assume all payments and incomes (salary, mortgage, expenses and investment) will occur at the end of each month.
5. Assume investment in the bank account will be earning nominal interest rate 4% p.a. compounded monthly.
6. The current bank account balance is \$0.
7. Assume no salary tax or other expenses.

Questions:

1. Assume all your remaining salary will be invested in the bank account. (15 marks)
 - (1) Calculate when would you be able to purchase your first home with the home loan described above. (5 marks)
 - (2) Assume the remaining principle will be repaid in a 30-year home loan with monthly level payments.
 - (i) Calculate the monthly level payments you have to repay. (3 marks)
 - (ii) Calculate the total interest you have to repay throughout 30 years' time and the interest portion of your 15th payment. (2 marks)
 - (iii) Calculate your bank account balance in 30 years, right after you pay off your home loan. (1 marks)
 - (3) If you would like to pay off the loan as soon as possible, and it is ok to repay any amount of money per month.
 - (i) What is the quickest way to pay off the loan? (1 marks)
 - (ii) When will the loan be paid off? (2 marks)
 - (iii) What is the amount of the last payment? (1 marks)
2. Assume the remaining principal will be repaid in a 30-year home loan with monthly level payments, as discussed in 1(2). However, rather than putting all your remaining salary in a bank account, assume you choose to invest in one of the following two fixed interest securities, two years after you purchased your first home. And you will invest all your account balance at that time. (15 marks)

Bond A – A zero coupon bond redeemable in 15 years with a gross yield of 6% effective.

Bond B – Pays half yearly coupons of 4% p.a. (coupons are paid at the mid of each year and at the end of each year.) Redemption is at par on any coupon date between 10-15 years from the bond purchase date, at the decision of the issuer. This bond has a minimum gross yield of 9% p.a. effective.

- (1) Assuming you will invest in either Bond A or Bond B (but not both at the same time); calculate the nominal amount of each bond, which can be purchased. (7 marks)
- (2) Assume you are also subject to a tax of 20% on coupons and 30% on capital gains, payable immediately it is incurred, with coupons and redemption values to be invested in the bank account when they are received. The gross yields of the bonds are unchanged.

Compare the two bond investment options by calculating the bank account balances when you just pay off the 30-years home loan and select one with reasons. (8 marks)