**King Saud University**

**Department of Mathematics**

**First Mid Term Exam**

ACTU 361 - Mathematics of Finance (1)

(25/2/1437 H, Time 1H30)

**Question 1. [9]**

1. We consider an annuity-due with a term of n periods where the interest rate is i per period, and where the first payment is 1 at t=0.
2. We suppose that each subsequence payment is k% greater than the preceding payment. Prove that if $i\ne k$, then the present value of such annuity is equal to:

$$PV=(1+i)\frac{1-\left(\frac{1+k}{1+i}\right)^{n}}{i-k}$$

1. We suppose that each subsequence payment is k% less than the preceding payment. Prove that in this case the present value of such annuity is equal to:

$$PV=(1+i)\frac{1-\left(\frac{1-k}{1+i}\right)^{n}}{i+k}$$

1. Matthew makes a series of payments at the beginning of each year for 20 years. The first payment is $100. Each subsequent payment through the 9 first years increase by 5 % from the previous payment. From the 10th payment, each payment decreases by 5% from the previous payment.

Calculate the present value of these payments at t=0 using an annual effective rate of 7%.

**Question 2. [8]**

A contractor needs to buy a new truck which price of $ 20,000,

 by a loan that he will pay over 4 years with semiannual payments at an interest rate of 10% compounded semiannually.

Construct an amortization schedule for the contractor.

**Question 3. [8]**

A housing loan is to be repaid with a 15-year monthly annuity immediate of

$ 2,000 at an interest rate of 0,5 % per month.

1. Find the remaining balance $B\_{1}$ after 20 payments.
2. After 20 payments, the borrower stopped paying the installment for 10 months. What is the new amount $B\_{2} $of the remaining balance after 10 months?
3. When he start repaying the loan new installment, he has to pay a penalty equal to 1.5 % of the remaining balance $B\_{1}.$
4. Calculate the new remaining balance $B\_{3}$
5. Calculate the revised installment when the borrower start to pay back again so that the loan period remains unchanged.