University of Ruhuna
Department of Mathematics

Bachelor of Science (General) Degree (Level III)
MATHEMATICS
MAT327β: Introduction to Financial Mathematics

Tutorial No : 06 **Semester II, 2023**

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1. A cash outlay of \$100 generates incomes of \$20 after four months and eight months, and \$80 after two years. Calculate the IRR of the investment.

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2. An investor is asked to invest \$11,000 and is promised to return a payment of \$4,000 in one year, \$5,000 in the second year and \$4,500 in the third year. Find his IRR.

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3. A lender invests \$20,000 to make a loan which will be repaid with three annual end of year payments of \$8,000. What is the yield on this investment?

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4. Deposits of \$2,000 are made into an investment fund at time zero and one. The fund balance is \$2,200 at time one before the new investment and \$3,500 at time two. Compute the TWRR of the fund over the whole period.

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5. On January 1^{st}, a fund was valued at \$100. On April 1^{st}, the fund increased in value to \$140 and \$40 of new principal was injected. On October 16^{th}, the fund value dropped to \$125, and \$10 was withdrawn. At the end of the year, the fund was worth \$135. Calculate the DWRR and the TWRR.

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6. An investment manager had a fund of \$100,000 at the start of the year 2006. On February 1^{st} that fund had dropped to \$98,000 and a withdrawal of \$10,000 was made. On September 1^{st} the fund balance was \$100,000 and new deposit of \$10,000 was made. At year end the account balance was \$105,000. Find the time weighted and dollar weighted rates of return.

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7. On January 1^{st}, an account is worth \$70,000. After k months, the balance increases by 20%, and \$4,000 is withdrawn. $k+2$ months prior to the end of the year, the balance becomes \$88,000 and \$2,000 is deposited. After one year, the account is worth \$80,000. The DWRR of the account is 17.69%.

a) Find k.

b) Calculate the TWRR of the account.

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8. You are given the following information about the activity in two different investment accounts:

Account K

Date	Fund Value Before Activity	Activity Deposit	Activity Withdrawal
January 1, 1999	100.0		
July 1, 1999	125.0		X
October 1, 1999	110.0	2X	
December 31, 1999	125.0		

Account L

Date	Fund Value Before Activity	Activity Deposit	Activity Withdrawal
January 1, 1999	100.0		
July 1, 1999	125.0		X
December 31, 1999	105.8		

During 1999, the dollar-weighted (money-weighted) return for investment account K equals the time-weighted return for investment account L, which equals i. Calculate i.

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9. Project P requires an investment of \$4,000 at time zero. The investment pays \$2,000 at time one and \$4,000 at time two. Project Q requires an investment of X at time two. The investment pays \$2,000 at time zero and \$4,000 at time one. The net present values of the two projects are equal at an interest rate of 10%. Calculate X.

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10. An investor pays \$100,000 today for a four year investment that returns cash flows of \$60, 000 at the end of each of years three and four. The cash flows can be reinvested at 4.0% per annum effective. If the rate of interest at which the investment is to be valued is 5.0%, what is the net present value of this investment today?

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11. A used scanner can be purchased for \$150 cash or for \$65 down payment and \$50 at the end of each of the next two half-years. If you have a nominal interest preference rate of 7% convertible semiannually, will you pay cash now or pay by installments?

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12. A fund credits interest according to the following table:

Calendar year of investment (Y)	Investment year rates (%)				Portfolio rates (%)
	i_1^Y	i_2^Y	i_3^Y	i_4^Y	i^{Y+4}
2009	5.6	5.6	5.7	5.9	5.9
2010	5.6	5.6	5.7	5.9	5.8
2011	5.6	5.7	5.8	6.2	5.9
2012	5.8	5.9	6.0	6.3	X
2013	6.2	6.3	6.6	6.5	
2014	6.7	6.4	6.8		
2015	7.1	7.3			
2016	Z				

Assume all investments are made at the beginning of the year, and let

$M1$ = the total interest credited in the period 2013 through 2016 for an investment in 2009,

$M2$ = the total interest credited in the period 2013 through 2016 for an investment in 2013,

$M3$ = the total interest credited in the period 2013 through 2016 for an investment in 2013, if the balance is withdrawn at the end of every year and re-invested in the fund as new money in the following year.

Given that $M1 = M2 = M3$, find the two missing rates, X and Z, in the above table.

Supplementary Examples

13. An investor is asked to invest \$1,100 and is promised to return a payment of \$500 in one year and \$700 in the second year. Find the IRR.

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14. A fund has a value of \$10,000 at the beginning of the year. A deposit of \$300 was made at the end of every four months. A withdrawal of \$200 was made at the end of nine months. At the end of the year, the fund balance after the final deposit is \$11,000. Find the DWRR earned by the fund.

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15. Calculate the TWRR of the account.

Time mm/dd/yy	Contribution	Fund value before contribution
01/01/2017		1,000
04/01/2017	–300	500
08/01/2017	+2,000	250
12/31/2017		2,750

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16. Mike receives cash flows of \$100 today, \$200 in one year, and \$100 in two years. The present value of these cash flows is \$364.46 at an annual effective rate of interest i. Calculate i.

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