



CIFA PART I SECTION 1
FINANCIAL MATHEMATICS

MONDAY: 27 November 2017.

Time Allowed: 3 hours.

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Explain the following concepts as applied to indices:

- (i) Time reversal test. (2 marks)
- (ii) Factor reversal test. (2 marks)
- (iii) Base shifting. (2 marks)

(b) An index was at 100 in year 2012. The index rose by 6 per cent in year 2013 and subsequently fell by 4 per cent in year 2014. Thereafter, the index fell by 6 per cent in year 2015 and then rose by 5 per cent in year 2016.

Required:

- (i) Using year 2012 as the base year, calculate the index number for each year from year 2013 to year 2016. (4 marks)
- (ii) Using year 2014 as the base year, calculate the index numbers for the years 2012, 2013, 2015 and 2016. (4 marks)

(c) The demand and supply expression for products A and B are given as follows:

Demand

$$P_A = 1500 - 4q_A - 3q_B$$

$$P_B = 700 - q_A - 2q_B$$

Supply

$$P_A = 400 + 3q_A + q_B$$

$$P_B = 200 + q_A + q_B$$

Where P_A and q_A are the price and quantity demanded of product A respectively and P_B and q_B are the price and quantity demanded of product B respectively.

Required:

The prices and quantities to be sold of product A and product B. (6 marks)

(Total: 20 marks)

QUESTION TWO

(a) The table below shows the levels of disposable income and number of inhabitants in each level in two small counties namely; A and B.

Disposable Income (Sh. "000")	Number of Inhabitants	
	County A	County B
14 – 16	5	15
16 – 18	7	30
18 – 20	7	28
20 – 22	18	14
22 – 24	23	7
24 – 26	14	3
26 – 28	10	2
28 – 30	16	1

Required:

- (i) The mean disposable income in each county. (4 marks)
- (ii) The median disposable income in each county. (4 marks)
- (iii) The modal disposable income in each county. (4 marks)

(b) Motorcars Limited realised a profit of Sh.12,000 from selling 7 cars, Sh.12,400 from selling 9 cars and Sh.11,300 from selling 4 cars. The profit function is believed to be quadratic in nature.

Required:

- (i) Derive the profit function. (6 marks)
- (ii) Determine the number of cars that maximises profit. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) Highlight four assumptions made in basic discounted cash flow analysis. (4 marks)

(b) The data below relate to the revenue realised from sale of shares in a stock exchange:

Shares (quantity)	Revenue (Sh.)
2	108
3	416
3	783
6	1,056
4	664
2	526
1	340
5	610

Required:

- (i) Using the least squares method, determine the equation of best fit. (5 marks)
- (ii) The expected revenue if 9 shares are sold. (2 marks)

(c) The customer accounts of a certain supermarket have an average balance of Sh.120,000 and a standard deviation of Sh.40,000. The account balances are normally distributed.

Required:

- (i) The proportion of accounts whose balances are over Sh.145,000. (3 marks)
- (ii) The proportion of accounts whose balances are between Sh.90,000 and Sh.132,000. (3 marks)
- (iii) The proportion of accounts whose balances are below Sh.70,000. (3 marks)

(Total: 20 marks)

QUESTION FOUR

(a) State two advantages of the following statistical measures:

- (i) Standard deviation. (2 marks)
- (ii) Range. (2 marks)

(b) An investor is considering investing money in either one of two possible investment proposals. The investor's interest is to choose the investment with a higher average net present value and lower standard deviation and coefficient of variation.

The relevant data for the two investment proposals is as follows:

Investment Proposal A		Investment Proposal B	
Net present value (NPV) Sh. "000"	Probability	Net present value (NPV) Sh. "000"	Probability
1,559	0.20	-10,050	0.20
5,662	0.60	5,812	0.60
9,175	0.20	20,584	0.20

Required:

- (i) The expected net present values for each investment proposal. (4 marks)
 - (ii) The standard deviation of each investment proposal. (6 marks)
 - (iii) The coefficient of variation for each investment proposal. (4 marks)
 - (iv) Based on your calculations in (b) (i) to (b) (iii) above, advise the investor on the viable investment proposal. (2 marks)
- (Total: 20 marks)**

QUESTION FIVE

- (a) Explain three principles of capital budgeting decisions. (6 marks)
- (b) An investor is considering investing Sh.800,000 for a two year period. The data below relates to interest rates of three investment opportunities available:

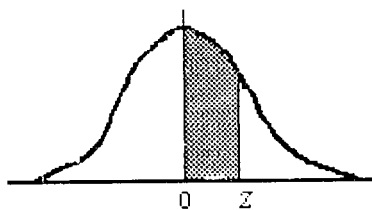
Investment opportunity	Interest
A	10% simple interest per annum.
B	9.5% per annum compounded semi-annually.
C	9% per annum compounded quarterly.

Required:

- The investment opportunity that would provide the highest return on investment for the two year period. (6 marks)
 - (c) A 4-year, 5.8% coupon bond is selling to yield 7%. The bond pays interest annually. The bond's interest rates decrease from 7% to 6.2% one year to maturity.
- Required:**
- (i) Price change attributable to moving to maturity. (4 marks)
 - (ii) Price change attributable to the change in the discount rate from 7% to 6.2%. (4 marks)
- (Total: 20 marks)**
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NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z



z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000