ZCAS University

MASTER OF SCIENCE IN FINANCIAL RISK MANAGEMENT

BAC5312 RISK MEASUREMENT TOOLS

MID-SEMESTER TEST

THURSDAY 26TH OCTOBER 2023

16:30 – 19:30 HRS

TIME ALLOWED: THREE HOURS (plus 5 minutes to read through the paper)

INSTRUCTIONS:

1. Section A: This question is **compulsory** and must be attempted.
2. Sections B: Answer **ANY TWO** questions from this section.
3. This examination paper carries a total of **100 marks.**
4. Please **do not turn this page** until the invigilator tells you to do so.

SECTION A: COMPULSORY QUESTION

QUESTION ONE

Zigzag Limited requires finances to build an assembly plant for manufacturing electric cars. You are the risk director at Zigzag. The projected production quantity is 50 units only to be sold at $20,000 per unit over the four-year useful life of the assembly plant. The cost of capital is 15%. Assume all variables will be constant over the life of the project. The other information relating to the cash flows is given in the table below.

Initial Investment - $950,000

Costs per unit:	**$**
Labour	6,000
Raw materials	7,000
Variable overheads	4,000

Your predictions in your risk report on the project to management are as follows:

i. *The selling price may fall by 3%,*
ii. *Sales quantity may go up by 5 %, and*
iii. *The cost of capital may go down to 10%.*

REQUIRED:

(a) ***Advise*** management at Zigzag Limited on at least five (5) uses of Sensitivity Analysis in decision-making process. **(10 marks)**

(b) ***Advise*** management at Zigzag Limited on at least five (5) limitations of Sensitivity Analysis as a risk measurement tool. **(10 marks)**

(c) ***Evaluate*** all the four possible situations for the electric car project using Sensitivity Analysis. **(20 marks)**

(d) ***Recommend*** whether Zigzag Limited should proceed to manufacture the electric car, in your recommendation clearly indicate which of the input variables are very sensitive ranking them in the order of their sensitivity starting with the most sensitive factor. **(10 marks)**

(Total: 50 marks)

SECTION B: ATTEMPT ANY TWO QUESTIONS

QUESTION TWO

You are a *risk consultant* at Graffities, a risk consulting firm. You will be presenting a paper on risk measurement tools to a cohort of Chief Executive Officers (CEOs) at a workshop before the end of October 2023. You are going to start with an introduction on risk and uncertainty. Some CEOs do not know that the most widely accepted approach to risk in financial markets focuses on measurement of volatility on certain returns and distributions. The volatility of portfolio returns depends on the variances and covariances between the risk factors of the portfolio and, the sensitivities of individual assets to risk factors. You are putting in the best of your effort in the preparation to ensure that the presentation will be simple and straight forward.

REQUIRED:

In your presentation,

(a) ***Advise*** the CEOs on what risk is, clearly highlighting five (5) distinguishing features between risk and uncertainty. **(5 marks)**

(b) ***Discuss*** five (5) risks inherent in international operations. **(10 marks)**

(c) ***Advise*** the CEOs on the Importance of risk measurement. **(5 marks)**

(d) ***Recommend*** to the CEOs at least at least five (5) risk measurement models that they can adopt in measuring risk in their organizations, give a brief explanation of each of the models you have recommended. **(5 marks)**

(Total: 25 marks)

QUESTION THREE

Emporium Limited manufactures treadmills. The company has completed its Research & Development (R&D) work on the Supersonic treadmill. The projected initial investment for the project is $25,000. The production plant has a useful life of four (4) years. The company's cost of capital is 12%. The company depreciation policy is straight line method. The residual value of the plant is $5,000. The Supersonic treadmill will most likely be sold at $60 each and variable cost estimate is $35 per unit, and the total cash fixed cost estimate is $5,000. The estimated annual sales volume is 900 Supersonic treadmills. Corporate tax rate is 35%. As a risk expert you are happy the estimates of all the cash flow variables are accurate. You have indicated to management at

Emporium, that two factors cannot be predicted with great certainty, and these are the selling price and sales volume. Forecasts have predicted sales volume for the Supersonic treadmills at a minimum of 600 units and maximum of 1,000 units. The selling price is expected to be in the range of $ 50 minimum to $ 70 maximum. The probabilities for the scenarios are as follows: Worst case 30%; Most likely case 50% and Best case 20%. The company will only accept projects with coefficient of variation of not more than 1.8.

REQUIRED:

(a) **Advise** management on what Scenario Analysis is and its significance as a risk measurement model. **(5 marks)**

(b) **Evaluate** the different cases presented in the narrative above using Scenario Analysis. **(15 marks)**

(c) **Recommend** whether management should decide to invest in the Supersonic treadmill on the backdrop of the risks highlighted in the evaluation. **(5 marks)**

(Total: 25 marks)

QUESTION FOUR

You are the *Chief Risk Project Advisor* at Nike Limited. Nike intends to introduce a new range of sports shoes called *Renteria.* It is considering whether to manufacture a sample of *Renteria* or to straight go into full production and putting it on the market. Nike plans to manufacture 1, 500 pairs of *Renteria.* If the Nike makes a sample, it will incur $200 per pair, and, no cost at all if no sample is produced. If the sample is done, there is 25% chance the sample may fail, and the cost impact will be $300 per pair. However, if the sample succeeds, the project could record sales of $700,000. If making a sample is ignored the Nike is taking a huge risk, the possible failure rate is 90% and the failure cost is estimated at $500 per pair. However, by not having a sample, should the project succeed, the project can bring in $650,000 in terms of revenue.

REQUIRED:

(a) **Evaluate** the project using Decision Tree Analysis (DTA).

i. By drawing an appropriate diagram using correct symbols and signs showing all the costs and payoffs. (*Marks will be lost for scruffy diagrams*). **(5 marks)**

ii. Determine the Expected Monetary Values (EMV) for deciding to make a sample before going into full scale production. **(5 marks)**

iii. Determine the Expected Monetary Values (EMV) for directly producing *Renteria* without a sample. **(5 marks)**

iv. **Advise** management at Nike Ltd on the decision to take on *Renteria*, whether to start first with making a sample, or to go directly into full scale production without a sample. The advice must be based by proper basis based on your evaluation of the project.

(5 marks)

(b) **Advise** management at Nike Limited on the following:

i. Machine Learning and its usefulness as a risk measurement tool in decision making.

(2 marks)

ii. Why Machine Learning is better compared to traditional or conventional Decision Tree Analysis when making risky decisions. **(3 marks)**

(Total: 25 marks)

END OF TEST

Formulae and Tables

1. Price = Coupon X $\frac{1}{r}\left[1 - \frac{1}{(1+r)^T}\right]$ + Par value X $\frac{1}{(1+r)^T}$

2. Probability of upstate $\pi u = (1 + r - d) / (u - d)$

3. Probability of down state $\pi d = 1 - \pi u$

4. Price of Call option $c_0 = [\pi u\, c^+ + (1 - \pi u)\, c^-] / (1 + r)$

5. $VaR = V_0 \alpha \sigma$

6. $P_0 = D_0(1+r)/r-g)$

7. CAPM

$$k_e = R_f + b\,(R_m - R_f)$$

8. WACC

$$kc = \left(\frac{D}{D+E}\right) kd\,(1 - t) + \left(\frac{E}{D+E}\right) ke$$

9. $NPV = CF_t/(1+r)^t - I_0$

10. standard deviation of the returns to the portfolio

$$\sigma_P = \sqrt{w_X^2\sigma_X^2 + w_Y^2\sigma_Y^2 + 2w_X w_Y \rho \sigma_X \sigma_Y}$$

11. Price of Call Option

The Black-Scholes option pricing model

$$c = P_a N(d_1) - P_e N(d_2) e^{-rt}$$

Where:

$$d_1 = \frac{\ln(P_a / P_e) + (r + 0.5s^2)t}{s\sqrt{t}}$$

12. Price of Put Option

$$P = C - P_a + P_e e^{-rt}$$

Present Value Table

Present value of 1 i.e. $(1 + r)_{-n}$

Where r = discount rate
n = number of periods until payment

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	0·980	0·961	0·943	0·925	0·907	0·890	0·873	0·857	0·842	0·826	2
3	0·971	0·942	0·915	0·889	0·864	0·840	0·816	0·794	0·772	0·751	3
4	0·961	0·924	0·888	0·855	0·823	0·792	0·763	0·735	0·708	0·683	4
5	0·951	0·906	0·863	0·822	0·784	0·747	0·713	0·681	0·650	0·621	5
6	0·942	0·888	0·837	0·790	0·746	0·705	0·666	0·630	0·596	0·564	6
7	0·933	0·871	0·813	0·760	0·711	0·665	0·623	0·583	0·547	0·513	7
8	0·923	0·853	0·789	0·731	0·677	0·627	0·582	0·540	0·502	0·467	8
9	0·914	0·837	0·766	0·703	0·645	0·592	0·544	0·500	0·460	0·424	9
10	0·905	0·820	0·744	0·676	0·614	0·558	0·508	0·463	0·422	0·386	10
11	0·896	0·804	0·722	0·650	0·585	0·527	0·475	0·429	0·388	0·350	11
12	0·887	0·788	0·701	0·625	0·557	0·497	0·444	0·397	0·356	0·319	12
13	0·879	0·773	0·681	0·601	0·530	0·469	0·415	0·368	0·326	0·290	13
14	0·870	0·758	0·661	0·577	0·505	0·442	0·388	0·340	0·299	0·263	14
15	0·861	0·743	0·642	0·555	0·481	0·417	0·362	0·315	0·275	0·239	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	0·812	0·797	0·783	0·769	0·756	0·743	0·731	0·718	0·706	0·694	2
3	0·731	0·712	0·693	0·675	0·658	0·641	0·624	0·609	0·593	0·579	3
4	0·659	0·636	0·613	0·592	0·572	0·552	0·534	0·516	0·499	0·482	4
5	0·593	0·567	0·543	0·519	0·497	0·476	0·456	0·437	0·419	0·402	5
6	0·535	0·507	0·480	0·456	0·432	0·410	0·390	0·370	0·352	0·335	6
7	0·482	0·452	0·425	0·400	0·376	0·354	0·333	0·314	0·296	0·279	7
8	0·434	0·404	0·376	0·351	0·327	0·305	0·285	0·266	0·249	0·233	8
9	0·391	0·361	0·333	0·308	0·284	0·263	0·243	0·225	0·209	0·194	9
10	0·352	0·322	0·295	0·270	0·247	0·227	0·208	0·191	0·176	0·162	10
11	0·317	0·287	0·261	0·237	0·215	0·195	0·178	0·162	0·148	0·135	11
12	0·286	0·257	0·231	0·208	0·187	0·168	0·152	0·137	0·124	0·112	12
13	0·258	0·229	0·204	0·182	0·163	0·145	0·130	0·116	0·104	0·093	13
14	0·232	0·205	0·181	0·160	0·141	0·125	0·111	0·099	0·088	0·078	14
15	0·209	0·183	0·160	0·140	0·123	0·108	0·095	0·084	0·074	0·065	15

Annuity Table

Present value of an annuity of 1 i.e. $\frac{1-(1+r)^{-n}}{r}$

Where r = discount rate
n = number of periods

Discount rate (r)

Periods (n)	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	
1	0·990	0·980	0·971	0·962	0·952	0·943	0·935	0·926	0·917	0·909	1
2	1·970	1·942	1·913	1·886	1·859	1·833	1·808	1·783	1·759	1·736	2
3	2·941	2·884	2·829	2·775	2·723	2·673	2·624	2·577	2·531	2·487	3
4	3·902	3·808	3·717	3·630	3·546	3·465	3·387	3·312	3·240	3·170	4
5	4·853	4·713	4·580	4·452	4·329	4·212	4·100	3·993	3·890	3·791	5
6	5·795	5·601	5·417	5·242	5·076	4·917	4·767	4·623	4·486	4·355	6
7	6·728	6·472	6·230	6·002	5·786	5·582	5·389	5·206	5·033	4·868	7
8	7·652	7·325	7·020	6·733	6·463	6·210	5·971	5·747	5·535	5·335	8
9	8·566	8·162	7·786	7·435	7·108	6·802	6·515	6·247	5·995	5·759	9
10	9·471	8·983	8·530	8·111	7·722	7·360	7·024	6·710	6·418	6·145	10
11	10·368	9·787	9·253	8·760	8·306	7·887	7·499	7·139	6·805	6·495	11
12	11·255	10·575	9·954	9·385	8·863	8·384	7·943	7·536	7·161	6·814	12
13	12·134	11·348	10·635	9·986	9·394	8·853	8·358	7·904	7·487	7·103	13
14	13·004	12·106	11·296	10·563	9·899	9·295	8·745	8·244	7·786	7·367	14
15	13·865	12·849	11·938	11·118	10·380	9·712	9·108	8·559	8·061	7·606	15

(n)	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%	
1	0·901	0·893	0·885	0·877	0·870	0·862	0·855	0·847	0·840	0·833	1
2	1·713	1·690	1·668	1·647	1·626	1·605	1·585	1·566	1·547	1·528	2
3	2·444	2·402	2·361	2·322	2·283	2·246	2·210	2·174	2·140	2·106	3
4	3·102	3·037	2·974	2·914	2·855	2·798	2·743	2·690	2·639	2·589	4
5	3·696	3·605	3·517	3·433	3·352	3·274	3·199	3·127	3·058	2·991	5
6	4·231	4·111	3·998	3·889	3·784	3·685	3·589	3·498	3·410	3·326	6
7	4·712	4·564	4·423	4·288	4·160	4·039	3·922	3·812	3·706	3·605	7
8	5·146	4·968	4·799	4·639	4·487	4·344	4·207	4·078	3·954	3·837	8
9	5·537	5·328	5·132	4·946	4·772	4·607	4·451	4·303	4·163	4·031	9
10	5·889	5·650	5·426	5·216	5·019	4·833	4·659	4·494	4·339	4·192	10
11	6·207	5·938	5·687	5·453	5·234	5·029	4·836	4·656	4·486	4·327	11
12	6·492	6·194	5·918	5·660	5·421	5·197	4·988	4·793	4·611	4·439	12
13	6·750	6·424	6·122	5·842	5·583	5·342	5·118	4·910	4·715	4·533	13
14	6·982	6·628	6·302	6·002	5·724	5·468	5·229	5·008	4·802	4·611	14
15	7·191	6·811	6·462	6·142	5·847	5·575	5·324	5·092	4·876	4·675	15

Cumulative Normal Distribution Table

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990

INTEREST RATES – FUTURES

Dec 2		Open	Sett	Change	High	Low	Est. vol.	Open Int
Euribor 3m*	Jan	98.92	98.84	-0.09	98.92	98.85	471	2.84C
Euribor 3m*	Apr	0.00	98.94	-0.06	0.00	0.00	-	-
Euribor 3m*	Jun	99.05	98.99	-0.04	99.06	98.97	73.019	383.444
Euribor 3m*	Sep	99.05	99.01	-0.02	99.06	98.98	83.531	376.547
Euroswiss 3m*	Dec	100.02	99.97	-	100.03	99.96	2.627	51.251
Euroswiss 3m*	Mar	100.14	100.09	+0.08	100.18	100.08	9.329	62.43C
Euroswiss 3m*	Jun	100.15	100.11	+0.08	100.21	100.09	9.139	52.988
Sterling 3m*	Jan	0.00	98.95	-0.01	0.00	0.00	-	-
Sterling 3m*	Mar	98.95	98.93	-0.01	98.96	98.91	50.677	322.94E
Sterling 3m*	Jun	98.94	98.92	-	98.95	98.89	52.389	199.54E
Sterling 3m*	Sep	98.92	98.92	+0.03	98.94	98.88	49.335	194.771
Eurodollar 3m †	Jan	99.450	99.43	-0.030	99.450	99.420	6.038	21.495
Eurodollar 3m †	Apr	0.000	99.35	-0.040	0.000	99.350	-	42E
Eurodollar 3m †	Jun	99.350	99.32	-0.035	99.365	99.295	216.837	1,101.244
Eurodollar 3m †	Sep	99.315	99.30	-0.030	99.340	99.270	236.535	745.680
Fed Fnds 30d ‡	Dec	0.000	99.91	-	0.000	0.000	-	74.479
Fed Fnds 30d ‡	Jan	0.000	99.90	-	0.000	0.000	-	63.547
Fed Fnds 30d ‡	Feb	0.000	99.89	-	0.000	0.000	-	51.980
Euroyen 3m ‡‡	Jan	0.000	99.675	-	0.000	0 000	-	-
Euroyen 3m ‡‡	Mar	99.660	99.660	-0.005	99.665	99.660	2.466	228.119
Euroyen 3m ‡‡	Jun	99.665	99.660	-0.005	99.665	99.660	5.014	147.333
Euroyen 3m ‡‡	Sep	99.660	99.665	-	99.665	99.660	2.438	85.514