NANYANG TECHNOLOGICAL UNIVERSITY

SEMESTER 2 EXAMINATION 2023-2024

BR2211 Financial and Risk Analytics I

April 2024 Time Allowed: 2 ½ Hours

INSTRUCTIONS

1 This paper contains **SIX(6)** questions and comprises **SIX(6)** pages of questions and **FIVE(5)** pages of appendix.

2 Answer **ALL** questions.

3 This is a **Closed-book** examination.

4 The number of marks allocated is shown at the end of each question.

5 Begin your answer to each question on a separate page of the answer book.

6 Answers will be graded for content and appropriate presentation.

Note: Exam Questions begin on Page 2

Question 1

You are an investment manager looking after the pension fund for Company A's employees. The pension fund is liable to pay a fixed annual income to each retired employee until death of the employee. The level of fixed annual income of each employee varies and depends on the employee's pre-retirement salary and number of years' service at the company. Company A has reserved $20 billion's asset to meet this pension liability.

(a) Write down one example of diversifiable risk faced by Company A's pension fund. Explain how you can effectively manage the risk.

(3 marks)

(b) Write down two examples of systematic risk faced by Company A' pension fund. Explain how you can effectively manage each of these two risks.

(6 marks)

(c) You are provided with the following term structure of spot rates of the government bond. The spot rates are per annum effective rates. Calculate the arbitrage-free forward rates that are missing in the below table. Show your working process.

Term (t)	Spot Rate (r_0^t)	Forward Rate ($f_0^{t-1,t}$)
1	2.0%	2.0%
2	3.0%	?
3	3.5%	?

(Hint: Forward rate $f_0^{t-1,t}$ denotes the annual effective interest rate that is agreed upon today to be applicable between $t-1$ and t.)

(5 marks)

(d) You are told that the pension fund needs to grow at a minimum rate of 5% p.a., in order to meet the liability of paying future retirement benefits. You decide to invest 50% of the pension fund asset into the government bond (assuming risk free with return as per in (c)) and the remaining into an equity fund.

The equity fund's annual return follows a Normal distribution with mean of 10% and standard deviation of 20%. The employees at Company are relatively young and there will be no retirement income payments in the next year.

i) Calculate the 95% Value-at-Risk of next year's percentage investment return.

(4 marks)

ii) Calculate the shortfall probability of not meeting the minimum growth rate.

(4 marks)

(TOTAL: 22 marks)

Question 2

(a) Briefly describe the three stages in the workflow of data projects.

(6 marks)

(b) Briefly describe the five steps in a typical data analysis cycle.

(5 marks)

(TOTAL: 11 marks)

Question 3

You want to explore the relationship between a car's CO_2 emission and its features, including three variables: engine size, number of cylinders, and year of production.

(a) Set up a multiple linear regression model. Define each term and notation in the regression.

(5 marks)

(b) After running the multiple linear regression on 500 cars, you have obtained the following summary of errors:

- Total sum of squared errors is equal to 7,253;
- Regression sum of squared errors is equal to 4,799.

Calculate R^2 and Adjusted R^2 of this regression model.

(4 marks)

(c) Your manager suggests that you should include the interaction term of engine size and number of cylinders. You decide to perform a model selection based on AIC. You have obtained the following summary of errors for your manager's suggested model:

- Total sum of squared errors is equal to 7,253;
- Regression sum of squared errors is equal to 5,425.

Calculate AIC of the two models (the model in (b) and the model suggested by your manager). Propose which model should be used.

(5 marks)

(d) Propose a machine learning model that can help you explore more flexible patterns and interactions of these three explanatory variables. Explain why you propose this model.

(4 marks)

(TOTAL: 18 marks)

Question 4

You are a credit risk analyst at Bank ABC. You are provided with a dataset of 1,000 customers' credit and financial information. You decide to perform a binary regression model of the following:

$$\Pr\left(Y_i = 1 \middle| X_{i,1}, \dots, X_{i,p}\right) = H(\mu + \alpha_1 X_{i,1} + \alpha_2 X_{i,2} + \cdots + \alpha_p X_{i,p} + e_i),$$

where Y_i is the binary response variable, i.e. whether the i^{th} customer defaults or not (1 denotes default, and 0 denotes not default); $\{X_1, X_2, \dots, X_p\}$ are the p predictors (such as income, savings, debt); e_i is the error term; and $H(z)$ is a pre-defined function.

(a) Explain the characteristics of function $H(z)$ for a binary regression model.

(2 marks)

(b) You decide to use a Probit regression model and include three predictors in the Probit regression model: Income, Savings, and Debt amount. The outcome of estimating the Probit regression model is shown below. Interpret the results in terms of the impact of each predictor and whether they are significant.

```
Call:
glm(formula = DEFAULT ~ INCOME + SAVINGS + DEBT, family = binomial(link = "probit"),
    data = credit_data)

Deviance Residuals:
    Min        1Q    Median        3Q       Max
-1.7108   -0.8227   -0.7451    1.3612    2.2408

Coefficients:
              Estimate Std. Error z value Pr(>|z|)
(Intercept) -5.606e-01  6.382e-02  -8.783  < 2e-16 ***
INCOME      -2.222e-06  7.038e-07  -3.158  0.00159 **
SAVINGS     -1.433e-07  1.309e-07  -1.094  0.27380
DEBT         3.844e-07  7.240e-08   5.310  1.1e-07 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1193.4  on 999  degrees of freedom
Residual deviance: 1162.3  on 996  degrees of freedom
AIC: 1170.3
```

(6 marks)

(c) Using the estimated coefficients of the Probit regression model in (b), predict the default probability of a customer who has an income of \$100,000, savings of \$300,000, and a debt of \$800,000.

(6 marks)

(TOTAL: 14 marks)

Question 5

You are investigating the distribution of monthly inflation rate in Singapore. You decide to use an ARIMA(p,d,q) model.

(a) Set up an ARIMA(p,d,q) model. Define all notation in your model.

(4 marks)

(b) Briefly describe how you will use the Box-Jenkins Methodology to fit the ARIMA(p,d,q) model.

(6 marks)

(c) After diagnostic checks and model selections, you find the optimal model is of the following MA(1) model on differenced monthly inflation rate:

$$X_t = \mu + e_t + \beta e_{t-1}$$

where $\{X_t\}_{t\geq 0}$ is the differenced sequence of inflation rate, and $\{e_t\}_{t\geq 0}$ is a white noise process with mean 0 and standard deviation of σ.

i) Prove that X_t meets the weak stationary conditions.

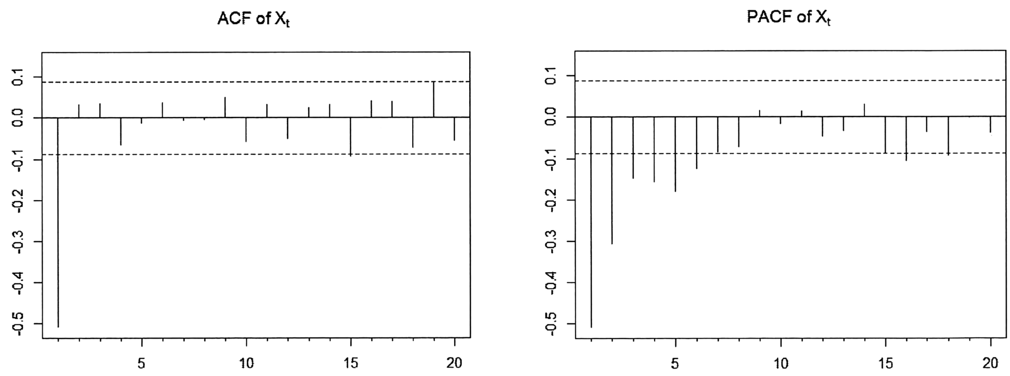
(5 marks)

ii) The estimated coefficient of the MA(1) model is $\hat{\beta} = -0.8$. Calculate the auto-correlation of this MA(1) model.

(3 marks)

iii) Below shows the ACF and PACF of X_t. Comment on whether MA(1) is an appropriate model for X_t.

(3 marks)



(TOTAL: 21 marks)

Question 6

You are a risk analyst at a derivative investment fund. You are asked to develop a pricing model for an exotic option, whose payoffs are determined by the average price of the underlying stock over the past 12 months, i.e. the option's payoff at the end of term (12 months) is:

$$\max\left\{0,\ \frac{Y_1+Y_2+\cdots+Y_{12}}{12}-K\right\},$$

where Y_t denotes the underlying stock's price at the end of month t, and $K = 150$ denotes the pre-determined strike price of the option.

After analyzing the historical data of monthly stock price, you find that the underlying stock's monthly price returns follow an AR(1) process, i.e.

$$X_t = \mu + \alpha(X_{t-1} - \mu) + e_t$$

where $X_t = \ln(Y_t) - \ln(Y_{t-1})$ denotes the underlying stock's price return in month t, and e_t denotes a white noise process with mean 0 and standard deviation of σ. You are also given the current stock price is $Y_0 = \$100$, and the latest period's return is $X_0 = 4\%$.

The estimated parameters are shown below:

Parameter	$\hat{\alpha}$	$\hat{\mu}$	$\hat{\sigma}$
Estimate	0.5994	0.0497	0.0802

The risk adjusted discount rate is 3% p.a. You want to use the Monte-Carlo simulation method to estimate the price of this exotic option.

(a) Set out an algorithm for generating simulated monthly prices of the underlying stock, using the inverse transform method. Clearly indicate the steps taking for the generating process.

(6 marks)

(b) Suppose you have generated simulated monthly price paths of the underlying stock in (a). Set out an algorithm for estimating the expected discounted payoff of this exotic option.

(5 marks)

(c) Suppose in Question (b) you have simulated 10,000 stock price paths. Using these simulations, you have estimated that the expected discounted payoff of the exotic option is \$24.51; and that the estimated sample variance of discounted payoff is 2,178. Construct a 95% confidence interval estimate of this exotic option's expected discounted payoff.

(3 marks)

(TOTAL: 14 marks)

– END OF PAPER –

Appendix: BR2211 Formulae and Tables

SAMPLE MEAN AND VARIANCE

The random sample $(x_1, x_2, \ldots, x_n)$ has the following sample moments:

Sample mean: $\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$

Sample variance: $s^2 = \frac{1}{n-1}\left\{\sum_{i=1}^{n} x_i^2 - n\bar{x}^2\right\}$

LINEAR REGRESSION MODEL WITH NORMAL ERRORS

Model

$$Y_i \sim N(\alpha + \beta x_i, \sigma^2), \quad i = 1, 2, \ldots, n$$

Intermediate calculations

$$s_{xx} = \sum_{i=1}^{n}(x_i - \bar{x})^2 = \sum_{i=1}^{n} x_i^2 - n\bar{x}^2$$

$$s_{yy} = \sum_{i=1}^{n}(y_i - \bar{y})^2 = \sum_{i=1}^{n} y_i^2 - n\bar{y}^2$$

$$s_{xy} = \sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y}) = \sum_{i=1}^{n} x_i y_i - n\bar{x}\,\bar{y}$$

Sum of squares relationship

$$\sum_{i=1}^{n}(y_i - \bar{y})^2 = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2 + \sum_{i=1}^{n}(\hat{y}_i - \bar{y})^2$$

Note: APPENDIX continues on page 8

APPENDIX (continued)

ANALYSIS OF VARIANCE

Single factor normal model

$$Y_{ij} \sim N(\mu + \tau_i, \sigma^2), \quad i = 1, 2, \ldots, k, \quad j = 1, 2, \ldots, n_i$$

where $n = \sum_{i=1}^{k} n_i$, with $\sum_{i=1}^{k} n_i \tau_i = 0$

Intermediate calculations (sums of squares)

Total: $SS_T = \sum_{i=1}^{k}\sum_{j=1}^{n_i}(y_{ij} - \bar{y}_{..})^2 = \sum_{i=1}^{k}\sum_{j=1}^{n_i} y_{ij}^2 - \frac{y_{..}^2}{n}$

Between treatments: $SS_B = \sum_{i=1}^{k} n_i(\bar{y}_{i.} - \bar{y}_{..})^2 = \sum_{i=1}^{k} \frac{y_{i.}^2}{n_i} - \frac{y_{..}^2}{n}$

Residual: $SS_R = SS_T - SS_B$

Variance estimate

$$\hat{\sigma}^2 = \frac{SS_R}{n-k}$$

where n is sample size, and k is the number of parameters in the model.

Goodness of fit

$$R^2 = 1 - \frac{SS_R}{SS_T}$$

$$\text{Adjusted } R^2 = 1 - \frac{MS_R}{MS_T}$$

AIC & BIC FOR LINEAR REGRESSION MODELS

$$\text{AIC} = n\,ln(\hat{\sigma}^2) + 2(1+p)$$

$$\text{BIC} = n\,ln(\hat{\sigma}^2) + ln(n)\,(1+p)$$

where $\hat{\sigma}^2$ is the estimated variance of residuals, p is the number of predictor variables in the model, and n is sample size.

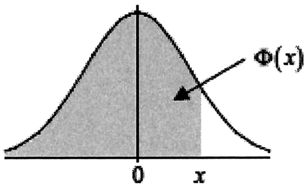
Note: APPENDIX continues on page 9

APPENDIX (continued)

Probabilities for the Standard Normal distribution

The distribution function is denoted by $\Phi(x)$, and the probability density function is denoted by $\phi(x)$.

$$\Phi(x)=\int_{-\infty}^{x}\phi(t)dt=\frac{1}{\sqrt{2\pi}}\int_{-\infty}^{x}e^{-\frac{1}{2}t^2}dt$$



x	Φ(x)	x	Φ(x)	x	Φ(x)	x	Φ(x)	x	Φ(x)
0.00	0.50000	0.40	0.65542	0.80	0.78814	1.20	0.88493	1.60	0.94520
0.01	0.50399	0.41	0.65910	0.81	0.79103	1.21	0.88686	1.61	0.94630
0.02	0.50798	0.42	0.66276	0.82	0.79389	1.22	0.88877	1.62	0.94738
0.03	0.51197	0.43	0.66640	0.83	0.79673	1.23	0.89065	1.63	0.94845
0.04	0.51595	0.44	0.67003	0.84	0.79955	1.24	0.89251	1.64	0.94950
0.05	0.51994	0.45	0.67364	0.85	0.80234	1.25	0.89435	1.65	0.95053
0.06	0.52392	0.46	0.67724	0.86	0.80511	1.26	0.89617	1.66	0.95154
0.07	0.52790	0.47	0.68082	0.87	0.80785	1.27	0.89796	1.67	0.95254
0.08	0.53188	0.48	0.68439	0.88	0.81057	1.28	0.89973	1.68	0.95352
0.09	0.53586	0.49	0.68793	0.89	0.81327	1.29	0.90147	1.69	0.95449
0.10	0.53983	0.50	0.69146	0.90	0.81594	1.30	0.90320	1.70	0.95543
0.11	0.54380	0.51	0.69497	0.91	0.81859	1.31	0.90490	1.71	0.95637
0.12	0.54776	0.52	0.69847	0.92	0.82121	1.32	0.90658	1.72	0.95728
0.13	0.55172	0.53	0.70194	0.93	0.82381	1.33	0.90824	1.73	0.95818
0.14	0.55567	0.54	0.70540	0.94	0.82639	1.34	0.90988	1.74	0.95907
0.15	0.55962	0.55	0.70884	0.95	0.82894	1.35	0.91149	1.75	0.95994
0.16	0.56356	0.56	0.71226	0.96	0.83147	1.36	0.91309	1.76	0.96080
0.17	0.56749	0.57	0.71566	0.97	0.83398	1.37	0.91466	1.77	0.96164
0.18	0.57142	0.58	0.71904	0.98	0.83646	1.38	0.91621	1.78	0.96246
0.19	0.57535	0.59	0.72240	0.99	0.83891	1.39	0.91774	1.79	0.96327
0.20	0.57926	0.60	0.72575	1.00	0.84134	1.40	0.91924	1.80	0.96407
0.21	0.58317	0.61	0.72907	1.01	0.84375	1.41	0.92073	1.81	0.96485
0.22	0.58706	0.62	0.73237	1.02	0.84614	1.42	0.92220	1.82	0.96562
0.23	0.59095	0.63	0.73565	1.03	0.84849	1.43	0.92364	1.83	0.96638
0.24	0.59483	0.64	0.73891	1.04	0.85083	1.44	0.92507	1.84	0.96712
0.25	0.59871	0.65	0.74215	1.05	0.85314	1.45	0.92647	1.85	0.96784
0.26	0.60257	0.66	0.74537	1.06	0.85543	1.46	0.92785	1.86	0.96856
0.27	0.60642	0.67	0.74857	1.07	0.85769	1.47	0.92922	1.87	0.96926
0.28	0.61026	0.68	0.75175	1.08	0.85993	1.48	0.93056	1.88	0.96995
0.29	0.61409	0.69	0.75490	1.09	0.86214	1.49	0.93189	1.89	0.97062
0.30	0.61791	0.70	0.75804	1.10	0.86433	1.50	0.93319	1.90	0.97128
0.31	0.62172	0.71	0.76115	1.11	0.86650	1.51	0.93448	1.91	0.97193
0.32	0.62552	0.72	0.76424	1.12	0.86864	1.52	0.93574	1.92	0.97257
0.33	0.62930	0.73	0.76730	1.13	0.87076	1.53	0.93699	1.93	0.97320
0.34	0.63307	0.74	0.77035	1.14	0.87286	1.54	0.93822	1.94	0.97381
0.35	0.63683	0.75	0.77337	1.15	0.87493	1.55	0.93943	1.95	0.97441
0.36	0.64058	0.76	0.77637	1.16	0.87698	1.56	0.94062	1.96	0.97500
0.37	0.64431	0.77	0.77935	1.17	0.87900	1.57	0.94179	1.97	0.97558
0.38	0.64803	0.78	0.78230	1.18	0.88100	1.58	0.94295	1.98	0.97615
0.39	0.65173	0.79	0.78524	1.19	0.88298	1.59	0.94408	1.99	0.97670
0.40	0.65542	0.80	0.78814	1.20	0.88493	1.60	0.94520	2.00	0.97725

Note: APPENDIX continues on page 10

APPENDIX (continued)

Probabilities for the Standard Normal distribution

x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
2.00	0.97725	2.40	0.99180	2.80	0.99744	3.20	0.99931	3.60	0.99984	4.00	0.99997
2.01	0.97778	2.41	0.99202	2.81	0.99752	3.21	0.99934	3.61	0.99985	4.01	0.99997
2.02	0.97831	2.42	0.99224	2.82	0.99760	3.22	0.99936	3.62	0.99985	4.02	0.99997
2.03	0.97882	2.43	0.99245	2.83	0.99767	3.23	0.99938	3.63	0.99986	4.03	0.99997
2.04	0.97932	2.44	0.99266	2.84	0.99774	3.24	0.99940	3.64	0.99986	4.04	0.99997
2.05	0.97982	2.45	0.99286	2.85	0.99781	3.25	0.99942	3.65	0.99987	4.05	0.99997
2.06	0.98030	2.46	0.99305	2.86	0.99788	3.26	0.99944	3.66	0.99987	4.06	0.99998
2.07	0.98077	2.47	0.99324	2.87	0.99795	3.27	0.99946	3.67	0.99988	4.07	0.99998
2.08	0.98124	2.48	0.99343	2.88	0.99801	3.28	0.99948	3.68	0.99988	4.08	0.99998
2.09	0.98169	2.49	0.99361	2.89	0.99807	3.29	0.99950	3.69	0.99989	4.09	0.99998
2.10	0.98214	2.50	0.99379	2.90	0.99813	3.30	0.99952	3.70	0.99989	4.10	0.99998
2.11	0.98257	2.51	0.99396	2.91	0.99819	3.31	0.99953	3.71	0.99990	4.11	0.99998
2.12	0.98300	2.52	0.99413	2.92	0.99825	3.32	0.99955	3.72	0.99990	4.12	0.99998
2.13	0.98341	2.53	0.99430	2.93	0.99831	3.33	0.99957	3.73	0.99990	4.13	0.99998
2.14	0.98382	2.54	0.99446	2.94	0.99836	3.34	0.99958	3.74	0.99991	4.14	0.99998
2.15	0.98422	2.55	0.99461	2.95	0.99841	3.35	0.99960	3.75	0.99991	4.15	0.99998
2.16	0.98461	2.56	0.99477	2.96	0.99846	3.36	0.99961	3.76	0.99992	4.16	0.99998
2.17	0.98500	2.57	0.99492	2.97	0.99851	3.37	0.99962	3.77	0.99992	4.17	0.99998
2.18	0.98537	2.58	0.99506	2.98	0.99856	3.38	0.99964	3.78	0.99992	4.18	0.99999
2.19	0.98574	2.59	0.99520	2.99	0.99861	3.39	0.99965	3.79	0.99992	4.19	0.99999
2.20	0.98610	2.60	0.99534	3.00	0.99865	3.40	0.99966	3.80	0.99993	4.20	0.99999
2.21	0.98645	2.61	0.99547	3.01	0.99869	3.41	0.99968	3.81	0.99993	4.21	0.99999
2.22	0.98679	2.62	0.99560	3.02	0.99874	3.42	0.99969	3.82	0.99993	4.22	0.99999
2.23	0.98713	2.63	0.99573	3.03	0.99878	3.43	0.99970	3.83	0.99994	4.23	0.99999
2.24	0.98745	2.64	0.99585	3.04	0.99882	3.44	0.99971	3.84	0.99994	4.24	0.99999
2.25	0.98778	2.65	0.99598	3.05	0.99886	3.45	0.99972	3.85	0.99994	4.25	0.99999
2.26	0.98809	2.66	0.99609	3.06	0.99889	3.46	0.99973	3.86	0.99994	4.26	0.99999
2.27	0.98840	2.67	0.99621	3.07	0.99893	3.47	0.99974	3.87	0.99995	4.27	0.99999
2.28	0.98870	2.68	0.99632	3.08	0.99896	3.48	0.99975	3.88	0.99995	4.28	0.99999
2.29	0.98899	2.69	0.99643	3.09	0.99900	3.49	0.99976	3.89	0.99995	4.29	0.99999
2.30	0.98928	2.70	0.99653	3.10	0.99903	3.50	0.99977	3.90	0.99995	4.30	0.99999
2.31	0.98956	2.71	0.99664	3.11	0.99906	3.51	0.99978	3.91	0.99995	4.31	0.99999
2.32	0.98983	2.72	0.99674	3.12	0.99910	3.52	0.99978	3.92	0.99996	4.32	0.99999
2.33	0.99010	2.73	0.99683	3.13	0.99913	3.53	0.99979	3.93	0.99996	4.33	0.99999
2.34	0.99036	2.74	0.99693	3.14	0.99916	3.54	0.99980	3.94	0.99996	4.34	0.99999
2.35	0.99061	2.75	0.99702	3.15	0.99918	3.55	0.99981	3.95	0.99996	4.35	0.99999
2.36	0.99086	2.76	0.99711	3.16	0.99921	3.56	0.99981	3.96	0.99996	4.36	0.99999
2.37	0.99111	2.77	0.99720	3.17	0.99924	3.57	0.99982	3.97	0.99996	4.37	0.99999
2.38	0.99134	2.78	0.99728	3.18	0.99926	3.58	0.99983	3.98	0.99997	4.38	0.99999
2.39	0.99158	2.79	0.99736	3.19	0.99929	3.59	0.99983	3.99	0.99997	4.39	0.99999
2.40	0.99180	2.80	0.99744	3.20	0.99931	3.60	0.99984	4.00	0.99997	4.40	0.99999

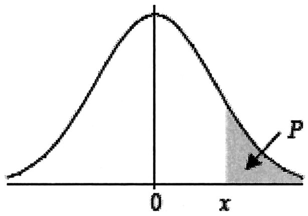
Note: APPENDIX continues on page 11

APPENDIX (continued)

Percentage Points for the Standard Normal distribution

The table gives percentage points x defined by the equation

$$P = \frac{1}{\sqrt{2\pi}} \int_x^{\infty} e^{-\frac{1}{2}t^2}\, dt$$



P	x	P	x	P	x	P	x	P	x	P	x
50%	0.0000	5.0%	1.6449	3.0%	1.8808	2.0%	2.0537	1.0%	2.3263	0.10%	3.0902
45%	0.1257	4.8%	1.6646	2.9%	1.8957	1.9%	2.0749	0.9%	2.3656	0.09%	3.1214
40%	0.2533	4.6%	1.6849	2.8%	1.9110	1.8%	2.0969	0.8%	2.4089	0.08%	3.1559
35%	0.3853	4.4%	1.7060	2.7%	1.9268	1.7%	2.1201	0.7%	2.4573	0.07%	3.1947
30%	0.5244	4.2%	1.7279	2.6%	1.9431	1.6%	2.1444	0.6%	2.5121	0.06%	3.2389
25%	0.6745	4.0%	1.7507	2.5%	1.9600	1.5%	2.1701	0.5%	2.5758	0.05%	3.2905
20%	0.8416	3.8%	1.7744	2.4%	1.9774	1.4%	2.1973	0.4%	2.6521	0.01%	3.7190
15%	1.0364	3.6%	1.7991	2.3%	1.9954	1.3%	2.2262	0.3%	2.7478	0.005%	3.8906
10%	1.2816	3.4%	1.8250	2.2%	2.0141	1.2%	2.2571	0.2%	2.8782	0.001%	4.2649
5%	1.6449	3.2%	1.8522	2.1%	2.0335	1.1%	2.2904	0.1%	3.0902	0.0005%	4.4172

– END OF APPENDIX –

BR2211 FINANCIAL & RISK ANALYTICS I

Please read the following instructions carefully:

1. **Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**

2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.

3. Please write your Matriculation Number on the front of the answer book.

4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.