Dept of Mathematics and Statistics
King Fahd University of Petroleum & Minerals
AS450: Risk Modelling
Dr. Mohammad H. Omar
Major 1 Exam Term 231 FORM 001

Name_____ ID#:_____ Serial #:___

Instructions.

1. Mobile calculators, I-pad, smart watches, or communicable devices **are disallowed**.
   a. Please **do not bring** your cell phones, smart watches, or other electronic devices in the exam.
   b. If you bring these, **switch them off** and put **them** in the corner chair.
   c. The phone **must be switched off** to **avoid any disturbance** during the exam
2. Any student caught with these devices switched on during the exam will be considered under the **cheating rules** of the University
3. If you finish the test earlier and want to leave the room, please do so quietly so not to disturb others taking the test.
   a. **No bathroom break during exam.** You can only leave the room after the exam or use the bathroom before the exam starts.
   b. **No two person** can leave the room at the same time.
   c. **No extra time** will be provided for the time missed outside the classroom.
4. Only materials provided by the instructor can be present on the table during the exam.
5. While every attempt is made to avoid defective questions, sometimes they do occur. In the rare event that you believe a question is defective, the instructor cannot give you any guidance beyond these instructions.
6. Do not spend too much time on any one question. If a question seems too difficult, leave it and go on.
7. Use the blank portions of each page for your work. Extra blank pages can be provided if necessary.
   a. If you use an extra page, indicate **clearly your name and what problem** you are working on.
8. Only **problem-solving** answers supported by work will be considered. Unsupported guesses will not be graded.
9. Use regular scientific calculators or SoA approved calculators only.
   a. But write **important steps** to arrive at the solution of the problem-solving questions.
10. Record your final answers to the multiple-choice questions on the OMR sheet.
    a. Submit the physical OMR page to your proctor
    b. Submit your answers to problem-solving questions to your proctor

The test is 90 minutes, GOOD LUCK, and you may begin now!

Exam date: Thursday Oct 5 2023 6.00pm - 7.30pm. bldg. 24 room 151

Q1. Which of the following does **not state the correct** historical or current roles of investment banks?

A) original role of investment banks was to raise debt and equity funds for customers
B) original role of investment banks was to advise on corporate actions such as mergers and acquisitions
C) investment banks now buy and sell securities and derivatives
D) investment banks provide advise to clients how to manage mortgage accounts
E) investment banks monitors investment accounts for their customers

Q2. Which of the following **correctly** describes one of the two main sources of credit risk for an insurance company?

A) risk of reinsurer failure
B) risk due to failure of information technology
C) risk due to fraudulent claims
D) risk cashflows due to difference in foreign exchange from the intended currency
E) risk due to regulations and legislation from government

Q3. Which of the following is **not** part of the **risk identification** process?

A) The tools that can be used
B) the ways in which the tools are used
C) assessment of the nature of the risk
D) the way in which the risk is recorded
E) the assets involved in identifying the risks

Q4. Which of the following is **true** when using a SWOT analysis?

A) Weakness is not important when strength has been identified
B) Weakness is important only if it informs an organization of its exposure to a threat
C) SWOT analysis uncovers only positive prospects for future company's strategies
D) Increased regulation is one example of opportunities facing an organization
E) SWOT analysis should not be used for strategy development

Q5. Which of the following is **not part** of an Enterprise Risk Management framework?

A) assess the context in which the framework is operating
B) a consistent risk taxonomy is needed to promote an organization-wide understanding of risks
C) the risks to which an organization is exposed must be identified
D) implementing strategies to address risks
E) the CEO is solely responsible for the management of risks

Q6. Consider two insurance claims, X and Y. The probability that claim X is less than or equal to \$40 000 is 0.85, whilst the probability that claim Y is less than or equal to \$35 000 is 0.94. If the claims are linked by a Gumbel copula with a parameter α of 2.5, what is the probability that both X is less than or equal to \$40 000 and Y is less than or equal to \$35 000?

A) 0.1064
B) 0.6567
C) 0.8452
D) 0.8610
E) 0.8950

Q7. The probability that a particular project, *X*, will make a loss (that is, will produce a return of less than zero) is 0.15, whilst the probability that another project, *Y*, will make a loss is 0.25. The correlation measured using Kendall's tau, between returns on *X* and *Y* is 0.5. Returns on *X* and *Y* are linked by a Clayton copula. Calculate the probability that both projects make a loss.

A) 0.1002
B) 0.1297
C) 0.2005
D) 0.2501
E) 0.5000

Q8. Compute the coefficient of **lower tail** dependence for a Gumbel copula with parameter $\alpha = 4$.

A) -7
B) -3
C) 0
D) 5
E) 10

Q9. Consider the chief executives of firms *X* and *Y*. Company specific shocks lead to firm *X* replacing its chief executive on average once every 2 years, whilst company specific shocks lead to firm *Y* replacing its chief executive on average once every 4 years. Furthermore, economy-wide shocks lead to firms replacing their chief executive once every 8 years. Assuming these shocks occur in line with Poisson distributions, what is the probability that the chief executive of firm *X* stays in post for **at least** a further 3 years and that the chief executive of firm *Y* stays in post for **at least** a further 4.5 years?

A) 0.04127 B) 0.04979 C) 0.15336 D) 0.18498 E) 0.0334

KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
DEPARTMENT OF MATHEMATICS AND STATISTICS
AS 450: Risk Modelling - Semester 231,
Major 1 Exam Thursday Oct 5, 2023 (6:00 pm - 7:30 pm)
Your instructor's name: Dr. Mohammad H. Omar
Name: _____ ID #:_____ Serial#:_____

Part 1 (2 marks each). Please mark the correct answer to each of the questions by completely darkening the oval of your choice with a dark pen or pencil.

MULTIPLE CHOICE:	A	B	C	D	E
Q1	O	O	O	O	O
Q2	O	O	O	O	O
Q3	O	O	O	O	O
Q4	O	O	O	O	O
Q5	O	O	O	O	O

MULTIPLE CHOICE:	A	B	C	D	E
Q6	O	O	O	O	O
Q7	O	O	O	O	O
Q8	O	O	O	O	O
Q9	O	O	O	O	O

Score: ___ / 25

Code: 001

Q10. (**2+2=4 marks**) Consider claims on two insurance products, X and Y. An actuarial analyst is using the Frechet-Hoeffding's copula with $p = 0.3$ and $q = 0.9$ to model the joint probabilities of claims from these two insurance products. Calculate the following concordance index between X and Y:

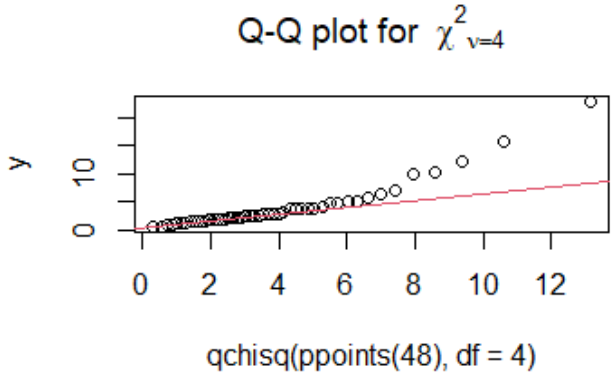
a) the **Kendall's Tau** _____.

b) the **Spearman rho** _____.

Q11. (**1+3 = 4 marks**) Some *R* output on a multivariate analysis of the Fisher's iris data is given below

	Beta-hat	kappa	p-val
Skewness	10.22740	81.819229	1.923968e-09
Kurtosis	32.23929	4.119643	3.794604e-05

	area	peri	shape	perm	mahal	P
1	4990	2791.9	0.0903296	6.3	3.9200	0.41694
2	7002	3892.6	0.148622	6.3	2.6587	0.61646
3	7558	3930.66	0.183312	6.3	1.9069	0.75288
4	7352	3869.32	0.117063	6.3	2.3503	0.67163
5	7943	3948.54	0.122417	17.1	1.8301	0.76696
6	7979	4010.15	0.167045	17.1	1.5584	0.81625
7	9333	4345.75	0.189651	17.1	1.5106	0.82476
8	8209	4344.75	0.164127	17.1	2.7005	0.60912
9	8393	3682.04	0.203654	119	0.6335	0.95927
10	6425	3098.65	0.162394	119	1.0451	0.90288
11	9364	4480.05	0.150944	119	2.3524	0.67125
12	8624	3986.24	0.148141	119	1.2454	0.87056
13	10651	4036.54	0.228595	82.4	2.4566	0.65243
14	8868	3518.04	0.231623	82.4	1.3505	0.85275
15	9417	3999.37	0.172567	82.4	0.9438	0.91819
16	8874	3629.07	0.153481	82.4	1.0426	0.90326
17	10962	4608.66	0.204314	58.6	2.1918	0.70054
18	10743	4787.62	0.262727	58.6	3.9161	0.41748
19	11878	4864.22	0.200071	58.6	3.1275	0.53673
20	9867	4479.41	0.14481	58.6	1.8387	0.76540
21	7838	3428.74	0.113852	142	1.5689	0.81438
22	11876	4353.14	0.291029	142	5.1993	0.26745
23	12212	4697.65	0.240077	142	3.9513	0.41264
24	8233	3518.44	0.161865	142	0.5756	0.96574
25	6360	1977.39	0.280887	740	0.7816	0.94090
26	4193	1379.35	0.179455	740	2.4518	0.65329
27	7416	1916.24	0.191802	740	2.1678	0.70493
28	5246	1585.42	0.133083	740	3.6781	0.45132
29	6509	1851.21	0.225214	890	1.6606	0.79787
30	4895	1239.66	0.341273	890	2.6627	0.61576
31	6775	1728.14	0.311646	890	1.6348	0.80252
32	7894	1461.06	0.276016	890	3.7257	0.44440
33	5980	1426.76	0.197653	950	2.7677	0.59741
34	5318	990.388	0.326635	950	2.2119	0.69685
35	7392	1350.76	0.154192	950	6.9421	0.13898
36	7894	1461.06	0.276016	950	3.6577	0.45431
37	3469	1376.7	0.176969	100	5.1507	0.27218
38	1468	476.322	0.438712	100	22.8964	0.00013
39	3524	1189.46	0.163586	100	6.3458	0.17477
40	5267	1644.96	0.253832	100	5.5521	0.23519
41	5048	941.543	0.328641	1300	4.8364	0.30450
42	1016	308.642	0.230081	1300	12.2679	0.01547
43	5605	1145.69	0.464125	1300	10.3082	0.03554
44	8793	2280.49	0.420477	1300	10.0765	0.03916
45	3475	1174.11	0.200744	580	2.1431	0.70946
46	1651	597.808	0.262651	580	4.7576	0.31309
47	5514	1455.88	0.182453	580	1.8320	0.76662
48	9718	1485.58	0.200447	580	15.6163	0.00358



QQ plot

a) Provide the **estimate of the multivariate skewness-type** parameter**.** [ ].

b) Provide the **correct decision criteria and conclusion** on the data based on the analysis given above.