College of Science.
Department of Statistics & Operations Research

كلية العلوم
قسم الإحصاء وبحوث العمليات

Final Exam
Academic Year 1443-1444 Hijri- First Semester

Exam Information معلومات الامتحان			
Course name	Credibility		اسم المقرر
Course Code	Actu 465		رمز المقرر
Exam Date	2021-12-22	1442-05-18	تاريخ الامتحان
Exam Time	01: 00 PM		وقت الامتحان
Exam Duration	2 hours	ساعتان	مدة الامتحان
Classroom No.			رقم قاعة الاختبار
Instructor Name			اسم استاذ المقرر

Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

General Instructions:

- Your Exam consists of 1 PAGES (except this paper)
- Keep your mobile and smart watch out of the classroom.
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تعليمات عامة:

- عدد صفحات الامتحان 1 صفحة. (بإستثناء هذه الورقة)
- يجب إبقاء الهواتف والساعات الذكية خارج قاعة الامتحان.
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هذا الجزء خاص بأستاذ المادة

This section is ONLY for instructor

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
1				
2				
3				
4				
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EXAM COVER PAGE

Exercise 1 *In a portfolio of insurance policies, the number of claims for each policyholder in each year, denoted by N, may be 0, 1, or 2, with the following pf: $f_N(0) = 0.1, f_N(1) = 0.9 - \theta, f_N(2) = \theta$. The prior pdf of Θ is*

$$f_\Theta(\theta) = \frac{\theta^2}{0.039} \qquad 0.2 < \theta < 0.5$$

A randomly selected policyholder has two claims in Year 1 and two claims in Year 2. Determine the Bayes estimate of the expected number of claims in Year 3 of this policyholder.
(1) 1.722 (2) 0.722 (3) 0.322 (4) 1.319

Exercise 2 *Let S_j the total losses experienced by a policyholder at period $j = 1, 2, ..., n$ and S_j is a coumpound Poisson and loss amounts have mean 5 and variance 100. Determine the expected total number of claims required for full credibilty if*
a) The aggregate losses must be within 3% of expected aggregate losses 95% ofthe time.
b) The actual number of claims must be within 3% of the expected number of claims with probability of 95%.

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Ex 1

$N|\theta$ ← 0 : 0.1; 1 : $0.9-\theta$; 2 : θ

$n_1 = n_2 = 2$; $n = (2,2)$

$$E[N_3|\theta] = 1(0.9-\theta) + 2\theta = 0.9+\theta$$

$$\pi[\theta|N=n] = \frac{f(n|\theta)\pi(\theta)}{\int f(n|\theta)\pi(\theta)d\theta} = \frac{\theta^2\left(\frac{\theta^2}{0.039}\right)}{C}$$

$$C = \int_{0.2}^{0.5} \theta^4 d\theta = \frac{1}{5}\left[0.5^5 - 0.2^5\right]$$

$$E[N_3|N=n] = \int E(N_3|\theta)\,\pi(\theta|N=n)\,d\theta$$

$$= \int (0.9+\theta)\frac{\theta^4}{C}d\theta = \frac{1}{C}\left[\int 0.9\theta^4 d\theta + \int \theta^5 d\theta\right]$$

$$= 1.3193.$$

Ex 2

$S_1 \ldots S_n$

$$S_i = \sum_{j=1}^{N_j} X_{ij} \qquad \mu_X = 5\,; \quad \sigma_X^2 = 100$$

(a) $$(\Sigma N_i)_E = \lambda_0\left(1 + C_X^2\right)$$

$$= \left(\frac{1.96}{0.03}\right)^2\left(1 + \frac{100}{21}\right) = 21,342$$

(b) $$(\Sigma N_i)_E = \lambda_0 = \left(\frac{1.96}{0.03}\right)^2 \simeq 4,268$$