Republic of Iraq
Ministry of Higher Education and Scientific Research
University of Basra
College of Administration & Economics
Department of statistics

Subject: Research Methodology \ M.S \ Date: /   / 2023
Final Exam : The Second semester 2022/2023

س1/ ما هي مقومات المشكلة البحثية الجيدة اذكر ذلك **(15 درجة)**

....

س2/ اذكر مستلزمات البحث الجيد. **(15 درجة)**

....

س3/اجب عن احد الفرعين : **(15 درجة)**

أ- ما هي القواعد الأساسية للاقتباس عدد خمسة منها.

ب- ما هي الأمور التي يجب مراعاتها عند صياغة الاستبيان.

....

س4/اجب عن الفرعين التاليين : **(10درجات)**

أ-اذكر القواعد التي اقترحها روسكو لتحديد حجم العينة.

ب- ما هي خصائص الفرضية الجيدة .

....

س5/ اختر الإجابة الصحيحة لما يأتي : **(15 درجات)**

1- في البحوث ....يكون حجم العينة 30 فردا لكل متغير في البحث.
a- البحوث التجريبية   b- البحوث الارتباطية   c- البحوث المسحية

2-......... هو الطريقة التي يسلكها الباحث في الإجابة عن الأسئلة .

a- فرضية البحث   b- منهجية البحث   c- الاستبيان

3- من صفات .... القدرة على التثبت من صحة الفروض.

a- البحث   b- الباحث   c- الاستبيان

4- من مواصفات .... ان يكون جديدا.

a-الاستبيان   b- الباحث   c- البحث العلمي

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5- من مقومات المشكلة البحثية الجيدة ان تكون :

a- دقيقة b- جديدة c- متكررة

6- عندما يقوم الباحث باقتباس المعلومات نصاً يسمى هذا الاقتباس :

a-اقتباس غير مباشر b- اقتباس مباشر c- اقتباس جزئي

7- من العوامل التي تساعد في تحديد حجم العينة هو :

a-فروض البحث b- منهجية البحث c- استبيان البحث

8- عند تقسيم العينة الى أجزاء مثل (ذكور , اناث) فان .الحد الأدنى لحجم العينة هو .... لكل فئة من الفئات.

10-a 20 -b 30 -c

9- عندما تعطى الحرية للمستجيب في الاستبيان بان يصوغ الإجابة التي يريد على سؤال ما فان هذا السؤال يعتبر من من نوع :

a-السؤال المفتوح b- السؤال المغلق c- السؤال المغلق المفتوح

10- في قواعد الاقتباس فان .... تعني ضرورة الإشارة الى المصادر التي تم الاقتباس منها.

a-الدقة b- الأمانة العلمية c- الاعتدال

....

Good Luck

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Subject: Time Series \ M.S \ Date: / / 2023

Final exam : the Second semester 2022/2023

Note: Answer only five questions. For each question (14 marks)

Q1\\ A: Correct the wrong statements if any?

1.The HP filter is non-causal and is appropriate for prediction

2. A discrete time series can be easily transformed to continuous one by merging data together over a specified time interval.

3. Is taken on the Hodrick- Prescott Filler is that the trend and the cyclic component are perfectly negatively correlation

4. The class of deterministic trend models cannot be reduced to a stationary process by detrending.

5. The average conditional variance reflects the extra variability introduced by the moving average term.

6. The system exhibit random walk, If one of more $|c_p| = 1$ **and none are zero .**

7. The variance must be estimated using a Heteroskedasticity Autocorrelation Consistent variance estimator when using unit roots tests.

B: Explain mathematically the properties of hysteresis.

Q2\ A: Choose the correct answer to fill in the blanks the following.

1. The causal time series has the ………correlation structure of a non-causal time series.

a. different b. same c. unknown d. not what was mentioned

2. Exponentially Weighted Moving Averages which place ………. weight on recent data than on past data weight

a. greater b. Less c. equal d. not what was mentioned

3. Over-differencing occurs when the difference operator is applied to a……… series.

a. nonstationary b. stationary d. not what was mentioned

4. If …………the values are unchanged in absolute terms, it oscillates between (+ , -).

a. $|\varphi_1| = 1$ b. $|\varphi_1| = -1$ c. $|\varphi_1| = \pm 1$ **d. not what was mentioned**

5. That the strength of the test when rejected the null that the process contains a unit root when characteristic root is less than 1.

a. Least b. unknown c. Largest d. not what was mentioned

B. Consider Markov model $Z(t) = \phi(Z_{t-1}) + \varepsilon_t$ **, where** ε_t **is the white noise. Discuss the stationarity, where** $|\phi| \le 1$.

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Q3\\ Choose the correct answer with clarification when choosing:

1. The partial covariance/correlation between X^t and X_{t+k+1} is defined as the partial covariance/ correlation between Xt and Xt+k+1 after conditioning out the `in between' time series $X_{t+1},\ldots,X_{t+k}$, then $P_{X_k}(X_0)$ **equal**

a. $\sum_{j=1}^{k}\phi_{k,k+j}X_j$ **b.** $\sum_{j=1}^{k}\phi_{k,k-j}X_0$ **c.** 0 **d. not what was mentioned**

2. $y_t = 1-0.8y_{t-1}+0.2y_{t-2}+x_t$ the characteristic rots is

a. $(-1,0.2)$ *b.* $(0.6,0,4)$ *c.* $(-0.2,0.1)$ **d. not what was mentioned**

3. assuming covariance stationarity the unconditional variance be ,

a. σ_t^2 *b.* $\sigma^2/(1-\phi)$ *c.* $\sigma^2/(1-\phi^2)$ **d. not what was mentioned**

4. Let $\underline{y_t}$ be a series that may be autocorrelated $y_t^* = y_t - \bar{y}$ **where** $\bar{y} = T^{-1}\sum_{t=1}^{T} y_t$ **. The *L*-lag Newey-West variance estimator for the variance of** $\bar{y}$ **is**

a. $\hat{\sigma}_{NW}^2 = \hat{\gamma}_0 + 2\sum_{t=1}^{L} L+1/(L+1-l)\ \cdot T^{-1}\sum_{t=l+1}^{T} y_t^* y_{t-1}^*$

b. $\hat{\sigma}_{NW}^2 = 2\sum_{t=1}^{L} L+1-l/(L+1)\ \cdot T^{-1}\sum_{t=l+1}^{T} y_t^* y_{t-1}^* + \hat{\gamma}_0$

c. $\hat{\sigma}_{NW}^2 = \hat{\gamma}_0 + 2\sum_{t=l+1}^{T} y_t^* y_{t-1}^* \cdot\ (L-l)/(L+1)$

d. not what was mentioned

Q4 $Let\ X_{1,2} = (X_1, X_2)', X_{-(1,2)} = (X_3,\cdots,X_d)', \Sigma_{-(1,2)} = \mathrm{var}(X_{-(1,2)}),\ \underline{c}_{1,2} = \mathrm{cov}(X_{(1,2)}, X_{-(1,2)})\ \ and\ \ \Sigma_{1,2} = \mathrm{var}(X_{1,2})\, then\ \ \rho_{ij} = -\frac{\Sigma^{ij}}{\sqrt{\Sigma^{ii}}\sqrt{\Sigma^{jj}}}$

Q5\\ Forecasting is a common objective of many time-series models. The objective of a forecast is to minimize a loss function. So what are the properties of the loss function.

Q6\\ Prove that maximizing the likelihood is equivalent to minimizing the error variance.

Good Luck

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Subject: Advanced probability \ M.S \ Date: / / 2023
Final exam : the Second semester 2022/2023

Q1) A) Suppose that a bus arrives at a station everyday between 10:00 A.M and 10:30 A.M at random, let x be the arrival time, find the distribution of x and sketch its graph? (7 degree)

Q1) B) Let F be the distribution function of an arbitrary random variable R. Proof that $\lim_{x \to \infty} F(x) = 1$ (7 degree)

****

Q2) A) A child is lost at Epcot Center in Florida. The father of the child believes that the probability of his being lost in the east wing of the center is 0.75, and in the west wing 0.25. The security department sends three officers to the east wing and two to the west to look for the child. Suppose that an officer who is looking in the correct wing (east or west) finds the child, independently of the other officers, with probability 0.1. Find the probability that the child is found. (7 degree)

Q2) B) A box contains seven red and 13 blue balls, two balls are selected at random and are discarded without their colors being seen, if a third ball is drawn randomly and observed to be red, what is if probability that both of them discarded balls were blue? (7 degree)

****

Q3) A) A realtor claims that only 30% of the houses in a certain neighborhood are apprised at less than $200,000. A random sample of 20 houses from that neighborhood is selected and appraised. The results in (thousands of dollars) are as follows:

285	156	202	306	276	562	415
245	185	143	186	377	225	192
510	222	264	198	168	363	

Based on these data, is the realtor's claim acceptable. (7 degree)

Q3) B) Let F be the distribution function of an arbitrary random variable R . Proof that $\lim_{x \to x_0^+} F(x) = F\{x_0\}$ (7 degree)

يتبع لطفاً ←

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Subject: Advanced probability \ M.S \ Date: / / 2023

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Q4) A) Three cards are drawn from an ordinary deck and not replaced, find the probability of these.

1. **Getting 3 jacks.**
2. **Getting an ace, a king, and a queen in order.**
3. **Getting a club, a spade, and a heart in order.**
4. **Getting 3 clubs.** **(7 degree)**

Q4) B) Let F be the distribution function of an arbitrary random variable R.
Proof that $\lim_{x \to -\infty} F(x) = 0$ **(7 degree)**

****

Q5) A) the lifetime of a tire selected randomly from a used tire shop is 10, 000X miles,
Where X is a random variable with the density function.

$$f(x) = \begin{cases} \frac{2}{x^2} & 1 < x < 2 \\ 0 & elsewhere \end{cases}$$

(a) What percentage of the tires of this shop last fewer than 15,000 miles?
(b) What percentage of those having lifetimes fewer than 15,000 miles last between 10,000 and 12,500 miles? **(7 degree)**

Q5) B) Let R be a nonnegative random variable, and b a positive real number.
Proof that $P\{R \geq b\} \leq \frac{E(R)}{b}$ **(7 degree)**

****

Good Luck

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Subject: Statistical Inference **\ M.S \ Date: / / 2023**

Final exam : the Second semester 2022/2023

Note: The answer to five questions for each question is (14) marks

Q1)a- Define Rao-Black Well theorem and prove it ?

b- Show that if an unbiased estimator is a unique estimator to the parameter by giving example ?

Q2) Let $f(x,\theta)=\dfrac{1}{\pi(1+(x-\theta)^2)}$ $,-\infty<x<\infty$

Find Rao-Cramer lower bound for the variance of an unbiased estimator of θ?

Q3)a- If $x_1, x_2, \ldots, x_n$ has $N(r\theta, r^3\sigma^2)$

What is maximum likelihood estimator of θ?

b- Let $x_1, x_2, \ldots, x_n$ be a random sample of size n having p.d.f.
$f(x,\lambda)=\lambda x^{\lambda-1}$ $,0<x<1$

construct a B.C.R. for testing $H_0:\lambda=1\, against\, H_1:\lambda=2$

Q4) Let $x_1, x_2, \ldots, x_n$ be a random sample of size n from

Poisson distribution find the sequential probability ratio test for testing $H_0:\theta=0.02$ against $H_1:\theta=0.07$ what is average sample number when H_0 is true ?where $\alpha=2.20$, $\beta=0.10$

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Q5) Let $Y_1<Y_2<\ldots<Y_n$ be an order statistics of a random sample from a uniform distribution on $(\lambda_1-\lambda_2, \lambda_1+\lambda_2)$.

Prove that Y_1 and Y_n is a joint sufficient statistics of λ_1 *and* λ_2.

Q6) If $x_1, x_2, \ldots, x_{10}$ be a random sample from $N(0,\sigma^2)$

Find a B.C.R. of size $\alpha=0.01$ for testing H_0: σ^2 =1 against

H_1: σ^2 =2.

Where $\chi^2(10)=23.2$

(مع الامنيات بالنجاح)

رئيس القسم

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Good Luck

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Subject: Operation Research \ M.S \ Date: / / 2023
Final exam : the Second semester 2022/2023

***Remark : Answer 5 questions only**

Q1/A) True or False
(a) The dual of the dual problem yields the original primal.
(b) If the primal constraint is originally in equation form, the corresponding dual variable is necessarily unrestricted.
(c) If the primal constraint is of the type ≤, the corresponding dual variable will be nonnegative (nonpositive) if the primal objective is maximization (minimization).
(d) If the primal constraint is of the type ≥, the corresponding dual variable will be nonnegative (nonpositive) if the primal objective is minimization (maximization).
(e) An unrestricted primal variable will result in an equality dual constraint.

B) Consider the following LP:
Minimize z = 5x1 +12 x2+ 4 x3
subject to
x1 + 2x2+x3 ≤ 30
2x1 - x2+ 3x3 = 60
x1, x2 , x3 ≥ 0
The starting solution consists of artificial x5 the second constraint and slack x5 for the third constraint. The optimal tableau is given as

Basic	x1	x2	x3	x4	x5	b
Z	0	0	3/5	29/5	-2/5 +M	274/5
x2	0	1	-1/5	2/5	-1/5	12/5
x1	1	0	7/5	1/5	2/5	56/5

Write the associated dual problem, and determine its optimal solution in two ways

(14 degree)

Q2/ In the following problem, some of the variables have positive lower bounds. Use the bounded algorithm to solve these problems.
Maximize z = 3x1 + 5x2 + 2x3
subject to
x1 + 2x2 + 2x3≤ 10
2x1 + 4x2 + 3x3 ≤ 15

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$1 \leq x1 \leq 4,\ 0 \leq x2 \leq 3,\ 0 \leq x3 \leq 3$ (14 degree)

Q3/ Consider the following single-server queue: the inter-arrival time is exponentially distributed with a mean of 10 minutes and the service time is also exponentially distributed with a mean of 8 minutes, find the

(i) mean wait in the queue,
(ii) mean number in the queue
(iii) the mean wait in the system
(iv) mean number in the system
(v) proportion of time the server is idle

(14 degree)

Q4/ Find the optimum solution for the following L.P. Model

$$\text{Maximize } z = 2x1 + 3x2$$
$$\text{S.t}$$
$$7x1 + 5x2 \leq 36$$
$$4x1 + 9x2 \leq 35$$
$$x1,\ x2 \geq 0 \text{ and integer}$$

(14 degree)

Q5/ Following are the LP model and its associated optimal simplex tableau.
Maximize z = 3x1 + 4x2
subject to
$2x1 + 3x2 \leq 1200$ (Resistors2)
$2x1 + x2 \leq 1000$ (Capacitors2)
$4x2 \leq 800$ (Chips2)
$x1, x2 \geq 0$

Basic	x1	x2	x3	x4	x5	b
Z	0	0	5/4	1/4	0	1750
x1	1	0	-1/4	3/4	0	450
x5	0	0	-2	2	1	400
x2	0	1	1/2	-0.5	0	100

(a) Determine the status of each resource.

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(b) In terms of the optimal revenue, determine the dual prices for the resistors, capacitors and chips.

(c) Determine the feasibility ranges for the dual prices obtained in (b).

(d) If the available number of resistors is increased to 1300 units, find the new optimum solution.

(e) If the available number of chips is reduced to 350 units, will you be able to determine the new optimum solution directly from the given information? Explain.

Q6/Consider the following LP model:

Maximize $z = 5x_1 + 2x_2 + 3x_3$

subject to

$x_1 + 5x_2 + 2x_3 \leq b_1$

$x_1 - 5x_2 - 6x_3 \leq b_2$

$x_1, x_2, x_3 \geq 0$

The following optimal tableau corresponds to specific values of b_1 and b_2:

Basic	x1	x2	x3	x4	x5	b
Z	0	A	7	d	e	15
x1	1	B	2	1	0	3
x5	0	C	-8	-1	1	1

Determine the following:

(a) The right-hand-side values, b1 and b2.

(b) The optimal dual solution.

(c) The elements a, b, c, d, and e.

(14 degree)

GOOD LUCK

Examiner — ***Head of Department***

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Ministry of Higher Education and Scientific Research
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Subject: Experimental design \ M.S \ Date: 10 / 5 / 2023

Final exam : the Second semester 2022/2023

Note: answer five questions; including the second question

Q1/ if you have the linear model

$$y_{ij} = \mu + \tau_i + \epsilon_{ij} \quad i = 1, 2, \dots 4; j = 1, 2, \dots 6 \; ; \sum_i \tau_i = 0 \; ; \epsilon_{ij} \sim N(o, \sigma^2) \; ;$$

i- derive the $E(MSe)$ ii-Give $v(y_{21})$ ii-key out of ANOVA table (Give source of variation; d.f ; s.s ;mse ;F-test ,if (treatments are fixed and random)

Q2\ for the data of experiment, give the anova table

treatment		
t_1	t_2	t_3
12	2	-6
	4	-1
16	1	
	5	-9

Q3\ consider the following block designs with 5 blocks and with 4 treatments having a 2^2 factorial structure , randomize complete block design with 2 samples per E.U. and 2 measurement per sample

- **i- Write out an appropriate linear model**
- **ii- Out line the ANOVA table**
- **iii- Indicate you would test for main effects and interactions**
- **iv- Give the variance for $\hat{A}$ and give and give its estimator $\left(\left(var(\hat{A})\right)\right)$**

Q4\ : if we are have the linear model

$$y_{ij} = \mu + \tau_i + \epsilon_{ij} \qquad \tau_i \sim N(0, \sigma_\tau^2) \;\; ; \;\; \epsilon_{ij} \sim N(0, \sigma_e^2)$$

Find the i- $Cov(y_{23}; y_{2\acute{2}})$ ii- $Cov(y_{23}; y_{12})$

Q5\ 2^2 factorial the pattern basic replicate two time

Rep I

b_1	(1)	ab
b_2	a	B

Rep II

b_1	(1)	ab
b_2	a	b

Rep III

b_1	b	ab
b_2	(1)	a

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Use of intra- and inter-block information find the Key out of anova given sources of variation, degree of freedom, ss and MSE

Q6\ An experiment of a 2^3 factorial in blocks of size 2 . A suitable system of confounding will consist of 5 repetitions of the following types of replicates:

Type I: confounded AB, AC, BC - Type II : confounded AB,C,ABC

Type III: confounded A, BC, ABC - Type IV confounded B, AC, ABC

Type V confounded C, AB, ABC

- i- **How many blocks are requires?**
- ii- **What are the amounts of information that this design yield as compared to the un confounded design**

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Good Luck

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