United Arab Emirates University

STAT 101

Midterm Exam

23rd October, 2023

Name:

Roll Number:

- There are a total of 110 points in this Question Paper. Answer as much as you can. If your acquired score is greater than equal to 100 it will be counted as 100%.
- There are three parts in this Exam. Part-I involves TRUE/FALSE or Multiple Answer type questions, Part-II contains a few short answer type questions
- The Exam is scheduled for 75 minutes
- You may take help from the "Exam Assistance Note" containing a few required definitions and formula.

For instructor's use only

Problem Number	Obtained Score	Total Score
Problem 1		40
Problem 2		20
Problem 3		10
Problem 4		20
Problem 5		20
TOTAL		110
TOTAL(out of 100)		100

You May Use This Page for Rough Work

Part-I

Pick the correct answer option for the questions in this part of the exam.

1. (a) The Life, Education and Income indices for a country in the year 2010 is given as: Life Index = 80%, Education Index=75%, Income Index = 82%. What is the the **Human Development Index (HDI)** for the country in the year 2010.

Score:
Total Score: 10

Ans:
- 80.47%
- 78.94%
- 93.47%
- 82.16%

(b) **Statement:** A data set from a tourism company comprises of many variables including the name, age, gender, and the country of residence of its customers. If we consider the variable: **The country of residence of a customer**. Choose the correct option from below that best describes the **data-type of the variable**.

Score:
Total Score: 5

Ans:
- Numerical-Continuous
- Numerical-Discrete
- Categorical-Nominal
- Categorical-Ordinal

(c) **Statement:** A large corporate has a database to store its employee information including the variable yearly income of an employee. Which of the following option from the below correctly identifies the data-type of the variable: **yearly income of an employee?**

Score:
Total Score: 5

Ans:
- Numerical-Continuous
- Numerical-Discrete
- Categorical-Nominal
- Categorical-Ordinal

(d) It is given that the value of Life Expectancy (at birth) of a country is 68.5 years in a specific year. What is the value of the **Life Expectancy Dimension Index, I_{Life}** for the country?

Score:
Total Score: 10

Ans:
- 91.56%
- 81.53%
- 88.17%
- 76.74%

(e) According to the World DataBank the **Crude Birth Rate (CBR)** and the **Crude Death Rate** for the entire world in the year 2021 is given as 16.9 (per 1000 population) and 8.7 (per 1000 population). Then what is the world population growth rate (in percentages) **AGR**% in the year 2021?

Score:
Total Score: 10

Ans:
- 82.00%
- 8.20%
- 0.82%
- 0.082%

Part-II

Answer the following short type questions. Show your steps to get full credit.

2. (a) The population of UAE was 6.988 million in 2008 and 9.441 million in 2022. **Calculate the percentage increase of the population in UAE between the years 2008, and 2022.**

Score:
Total Score: 5

(b) b) Calculate the **Average Annual Growth Rate (AAGR%)** for the population growth of UAE during the period from 2008 to 2022.

Score:
Total Score: 10

(c) Assuming the AAGR% remains the same, provide the **Doubling Time (DT in years)** of the population in UAE.

Score:
Total Score: 5

4. The following table shows data on the global CO_2 emissions (in million metric tons of carbon) from the year 1980 to the year 2010 as provided by the Carbon Dioxide Information Analysis Center (CDIAC).

Year	Global CO_2 Emissions (in million metric tons of carbon)
1980	524.9
1985	804.8
1990	958.9
1995	1077.5
2000	1300.4
2005	1638.0
2010	2586.0

(a) Find the AAverage Annual Growth Rate **(AAGR%)** for CO_2 emission during the period **from 2000 to the year 2010.**

Score: _____
Total Score: 10

(b) **Predict the global CO_2 emission in year 2032 using 2010 as the base year.** Assume that the AAGR% for CO_2 emission remains fixed at the value that you have calculated in part (a) of this problem.

Score: _____
Total Score: 10

3 The following attributes of Chad in the year 2010 are provided in the table below:

	Life expectancy	Mean Years of Schooling	Expected Years of Schooling	Percapita Gross National Product (PcGNI)
Chad	57.1	7.1	9.7	1,385

Calculate the **Economic Index, $I_{Economic}$** of Chad in the year 2010? Show your steps.

Score:
Total Score: 10

5. The **world copper reserve** at the end of the year 2008 was known to be **490 million metric tons**, while in the year 2008, the world copper **consumption was 18.2 million metric tons**. Answer the following questions based on the provided information.

(a) Compute the **World Reserves Life Index (WRLI)** for Copper if its world consumption pattern remains the same as it was in the year 2008.

Score:
Total Score: 10

(b) If we assume that the global Copper consumption **grows annually at the rate AAGR=**1.2%, then how many years will it take to reach complete depletion of the 2008 world reserves?

Score: ____
Total Score: 5

(c) On the contrary, if the global Copper consumption **decreases annually at the rate AAGR=**0.9%, then how many years will it take to reach complete depletion of the 2008 world reserves?

Score: ____
Total Score: 5

Exam Assistance Note

X_0 = Value in the Base Year , X_n = Value in the Recent Year

$\hat{X}_{n+k}$ = Predicted Value in the Year $n+k$

CBR= Crude Brith Rate (out of 1000 population) , CDR= Crude Death Rate (out of 1000 population)

Percentage of Change	$\frac{X_n - X_0}{X_0} \times 100\%$
Average Annual Growth Rate	$\text{AAGR}\% = \left(\frac{X_n}{X_0}\right)^{\left(\frac{1}{n}\right)} \times 100 - 100\%$
Prediction in the year $n+k$ based on AAGR% and X_n	$\widehat{X}_{n+k} = X_n \times \left(\frac{100+AAGR}{100}\right)^{k}$
Average Growth Rate Percentage (AGR%) based on CBR and CDR	$\text{AGR}\% = \frac{\text{CBR} - \text{CDR}}{10}\%$

Related to Human Development Index (HDI)

PcGNI = Percapita Gross National Product

$$\text{General Dimension Index} := \frac{\text{Actual Value} - \text{Min}}{\text{Max} - \text{Min}}$$

$$\text{Income Index} : \text{I}_{\text{Income}} = \frac{\log(\text{PcGNI}) - \log(\text{Minimun PcGNI})}{\log(\text{Maximum PcGni}) - \log(\text{Minimun PcGNI})}$$

$$\text{Education Index} : \text{I}_{\text{Education}} = \frac{\sqrt{I_1 \times I_2}}{0.951}, \text{ where}$$

I_1 = Dimension Index for the Variable 'Mean Years of Adult Education '

I_2 = Dimension Index for the Variable 'Expected Years of Schooling '

$$\text{Human Development Index} : \text{HDI} = (\text{I}_{\text{Life}} \times \text{I}_{\text{Education}} \times \text{I}_{\text{Income}})^{\left(\frac{1}{3}\right)}$$

Name of Attribute	Minimum Value	Maximum Value
Life Expetancy	20	83.2
Mean Years of Adult Education	0	13.2
Expected Years of Schooling	0	20.6
Combined Education Index	0	0.951
Percapita GNI (PcGNI)	163	108211

Related to World Reserve Life Index (WRLI)

'World Reserve Life Index' provides an estimate for the years remaining before a specific world resource is expected to be completely depleted based on certain assumptions. Below are the related formula:

World Reserve Life Index (WRLI): If the the consumption remains fixed as it was in the year T, then the Number years of the year for a complete depletion of the Resource is:

$$\text{WRLI}_{\boxed{T}} = \frac{\text{World Reserve at the End of a Year } \boxed{T}}{\text{World Consumption in the Year } \boxed{T}}$$

$$\text{WR}\mathbf{B}\text{LI}_{\boxed{T}} = \frac{\text{World } \mathbf{Base} \text{ Reserve at the End of a Year } \boxed{T}}{\text{World Consumption in the Year } \boxed{T}}$$

World Reserve Life Index (WRLI): If the the consumption **Increases** by a Annual Average Growth Rate of $\boxed{\text{AAGR}}$ % from the year T, then the Number years of the year for a complete depletion of the Resource is:

$$\text{WRLI}^{*}_{\boxed{T},\ \text{AAGR}} = \frac{\log\left(1+\text{WRLI}_{\boxed{T}} \times \frac{\text{AAGR}}{100+\text{AAGR}}\right)}{\log\left(\frac{100+\text{AAGR}}{100}\right)}$$

World Reserve Life Index (WRLI): If the the consumption **Decreases** by a Annual Average Rate of $\boxed{\text{AAGR}}$ % from the year T, then the Number years of the year for a complete depletion of the Resource is:

- If $\left(1-\text{WRLI}_{\boxed{T}} \times \frac{\text{AAGR}}{100-\text{AAGR}}\right) > 0$, then

$$\text{WRLI}^{*}_{\boxed{T},\ \text{AAGR}} = \frac{\log\left(1-\text{WRLI}_{\boxed{T}} \times \frac{\text{AAGR}}{100-\text{AAGR}}\right)}{\log\left(\frac{100-\text{AAGR}}{100}\right)}$$

- $\left(1-\text{WRLI}_{\boxed{T}} \times \frac{\text{AAGR}}{100-\text{AAGR}}\right) \leq 0$, then the World Reserve on the material is never going to be depleted if we continue to decrease consumption at the specified rate. Eventually (hypothetically) the consumption will be almost zero before the resource gets depleted.

*The above calculation is based on the assumption that $AAGR\% < 100\%$.

!!! All the Best !!!