THE UNIVERSITY OF ZAMBIA

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SCHOOL OF NATURAL SCIENCES – 2021/2023

INSTITUTE OF DISTANCE EDUCATION

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INSTITUTE OF DISTANCE EDUCATION

2020/2021 ACADEMIC YEAR DEFERRED DISTANCE EXAMINATIONS

GES 2130: THE GEOGRAPHY OF AFRICA WITH SPECIAL REFERENCE TO ZAMBIA

TIME: **Three Hours**

INSTRUCTIONS: **Answer any three questions. All questions carry equal marks.**

Candidates are advised to make use of illustrations wherever

appropriate. Use of the Philips University Atlas is allowed.

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1. Discuss the significance of forests in Zambia.

2. Explain the formation of the Great East African Rift Valley and suggest at least three advantages of this physical feature to humans.

3. In which ways do the twin theories of Creation and Evolution explain the emergence of Early Man on the planet earth?

4. How can the concept of 'One Zambia, One Nation', be the proto-basis for promoting national unity in African countries despite linguistic diversity?

5. 'The diversity of natural resource potential in Africa should be used as a foundation to fight poverty, creation of jobs, livelihoods and prosperity through entrepreneurship' .Discuss.

END OF EXAMINATION

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INSTITUTE OF DISTANCE EDUCATION

2020/21 ACADEMIC YEAR FINAL EXAMINATIONS

GES: 2420 RESEARCH AND STATISTICAL METHODS IN GEOGRAPHY

TIME: Three Hours

INSTRUCTIONS: **Answer question 1 and three others**. Use of an approved calculator is allowed. Credit will be given for use of examples and illustrations.

1. A medical Geographer wanted to establish whether the body weight in kilogram of the Members of Parliament had an effect on their blood cholesterol levels measured in milligram per deciliter (mg/dl). The results are shown in Table 1. Using the results in Table 1 answer the questions that follow:

Table 1: Relationship between body weight and blood cholesterol levels

No	Body weight (kg)	Blood cholesterol level (mg/dl)
1	56	21
2	187	55
3	126	23
4	52	08
5	143	28
6	90	27
7	157	44
8	74	19
9	88	17
10	195	47

Source: *Hypothetical*

(a) Plot the data.
(b) Conduct a regression analysis so as to come up with a regression equation.
(c) Draw a line of best fit in your scatter diagram.
(d) Define your regression equation.
(e) How much blood cholesterol level in milligram per deciliter would you expect if the body weight of a parliamentarian is 205 kg?

2. High blood pressure is a leading cause of strokes. Medical researchers are consistently seeking ways to treat patients suffering from this condition. A specialist in hypertension claims that regular aerobic exercise can reduce high blood pressure just as successfully as drugs. Patients who suffer from high blood pressure were randomly selected to participate in the experiment. For 60 days one sample exercised whilst the other took standard medication. The percentage reduction in blood pressure was recorded in Table 2. Assuming data presented in Table 2 is normally distributed, can someone conclude that exercise is more effective than medication in reducing hypertension? Aim at 1% error in your results.

Table 2: Percentage reduction in blood pressure through exercise and use of drugs

Exercise	2.0	1.5	1.22	3.03	1.25	2.86	1.55	2.35	3.33	3.0	4.0	2.64	1.89	2.
Drugs	4.6	5.8	8.4	3.99	4.5	5.55	4.44	3.45	3.85	7.73	4.46	2.86		

Source: *Hypothetical*

3. Write short explanatory notes on ALL of the following:
   (a) Research design
   (b) Snow ball sampling
   (c) Sources of literature
   (d) Uses of statistics
   (e) Purpose of research

4. Describe as the main difference between Qualitative and Quantitative research.

5. You decide to conduct a study on the effects of climate variability in Chief Chipepo's area of Southern Province of Zambia,

   (a) Formulate a statement of the problem
   (b) Formulate the aim and three (3) objectives of the study
   (c) For each objective formulate two research questions
   (d) Suggest methods of analysis that you could use

6. Discuss the merits and de-merits of using a questionnaire in data collection.

END OF EXAMINATION

FORMULAE SHEET

$$t = \frac{\left|\bar{X} - \bar{Y}\right|}{\sqrt{\dfrac{\sum x^2 / n_x - \bar{X}^2}{n_x - 1} + \dfrac{\sum y^2 / n_y - \bar{Y}^2}{n_y - 1}}}$$

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{\left[n\sum x^2 - \left(\sum x\right)^2\right]\left[n\sum y^2 - \left(\sum y\right)^2\right]}}$$

$$r = \frac{\dfrac{\sum xy}{n} - \bar{X}\bar{Y}}{S_x S_y}$$

$$S_x = \sqrt{\frac{\sum x^2}{n} - \bar{X}^2}$$

$$S_y = \sqrt{\frac{\sum y^2}{n} - \bar{Y}^2}$$

$$H = \frac{12}{N(N+1)} \sum \frac{R^2}{n} - 3(N+1)$$

$$U_x = n_x n_y + \frac{n_x(n_x+1)}{2} - \sum r_x$$

$$U_y = n_x n_y + \frac{n_y(n_y+1)}{2} - \sum r_y$$

$$\hat{y} = a + bx$$

$$a = \bar{y} - b\bar{x} \quad OR \quad a = \frac{\sum y - b\sum x}{n}$$

$$b = \frac{\sum xy - n\bar{x}\bar{y}}{\sum x^2 - n\bar{x}^2} \quad OR \quad b = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$$

$$X^2 = \sum \frac{(O-E)^2}{E}$$

$$X^2 = \sum\sum \frac{(O_{i,j} - E_{i,j})^2}{E_{i,j}}$$

$$S^2 = \frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}$$

$$\hat{\sigma}_w^2 = \frac{\sum_{}^{k}\sum_{}^{n}(x-\bar{x})^2}{N-K} \quad OR \quad \hat{\sigma}_B^2 = \frac{\sum_{}^{k} n(\bar{x}-\bar{x}G)^2}{K-1}$$

$$F = \frac{\hat{\sigma}_B^2}{\hat{\sigma}_w^2}$$

Critical Values of Student's t

Degrees of freedom	Significance level (one-tailed)				
	0.05	0.025	0.01	0.005	0.0005
	Significance level (two-tailed)				
	0.1	0.05	0.02	0.01	0.001
1	6.31	12.71	31.82	63.66	636.62
2	2.92	4.30	6.97	9.93	31.60
3	2.35	3.18	4.54	5.84	12.92
4	2.13	2.78	3.75	4.60	8.61
5	2.01	2.57	3.37	4.03	6.86
6	1.94	2.45	3.14	3.71	5.96
7	1.89	2.37	3.00	3.50	5.41
8	1.86	2.31	2.90	3.35	5.04
9	1.83	2.26	2.82	3.25	4.78
10	1.81	2.23	2.76	3.17	4.59
11	1.80	2.20	2.72	3.11	4.44
12	1.78	2.18	2.68	3.05	4.32
13	1.77	2.16	2.65	3.01	4.22
14	1.76	2.15	2.62	2.98	4.14
15	1.75	2.13	2.60	2.95	4.07
16	1.75	2.12	2.58	2.92	4.01
17	1.74	2.11	2.57	2.90	3.97
18	1.73	2.10	2.55	2.88	3.92
19	1.73	2.09	2.54	2.86	3.88
20	1.73	2.09	2.53	2.85	3.85
21	1.72	2.08	2.52	2.83	3.82
22	1.72	2.07	2.51	2.82	3.79
23	1.71	2.07	2.50	2.81	3.77
24	1.71	2.06	2.49	2.80	3.75
25	1.71	2.06	2.49	2.79	3.73
26	1.71	2.06	2.48	2.78	3.71
27	1.70	2.05	2.47	2.77	3.69
28	1.70	2.05	2.47	2.76	3.67
29	1.70	2.05	2.46	2.76	3.66
30	1.70	2.04	2.46	2.75	3.65
40	1.68	2.02	2.42	2.70	3.55
60	1.67	2.00	2.39	2.66	3.46
120	1.66	1.98	2.36	2.62	3.37
∞	1.65	1.96	2.33	2.58	3.29

Reject H₀ if calculated value of t is **greater than** the critical value at the chosen significance level

Critical Values of Pearson's Product-Moment Correlation Coefficient r

Degrees of freedom	Significance level (one-tailed)			
	0.05	0.025	0.01	0.005
	Significance level (two-tailed)			
	0.1	0.05	0.02	0.01
1	0.9877	0.9969	0.9995	0.9999
2	0.900	0.950	0.980	0.990
3	0.805	0.878	0.934	0.959
4	0.729	0.811	0.882	0.917
5	0.669	0.755	0.833	0.875
6	0.622	0.707	0.789	0.834
7	0.582	0.666	0.750	0.798
8	0.549	0.632	0.716	0.765
9	0.521	0.602	0.685	0.735
10	0.497	0.576	0.658	0.708
11	0.476	0.553	0.634	0.684
12	0.458	0.532	0.612	0.661
13	0.441	0.514	0.592	0.641
14	0.426	0.497	0.574	0.623
15	0.412	0.482	0.558	0.606
16	0.400	0.468	0.543	0.590
17	0.389	0.456	0.529	0.575
18	0.378	0.444	0.516	0.561
19	0.369	0.433	0.503	0.549
20	0.360	0.423	0.492	0.537
25	0.323	0.381	0.445	0.487
30	0.296	0.349	0.409	0.449
35	0.275	0.325	0.381	0.418
40	0.257	0.304	0.358	0.393
45	0.243	0.288	0.338	0.372
50	0.231	0.273	0.322	0.354
60	0.211	0.250	0.295	0.325
70	0.195	0.232	0.274	0.302
80	0.183	0.217	0.257	0.283
90	0.173	0.205	0.242	0.267
100	0.164	0.195	0.230	0.254

Reject H_0 if calculated value of r is **greater than** the critical value at chosen significance level (in absolute terms).

TIME: Three hours

INSTRUCTIONS: Answer question 1 and any other **two**.

Candidates are advised to make use of illustrations and examples wherever appropriate.

1. Explain the concept of carbon trading elucidating its advantages and disadvantages for the rural communities in Zambia.

2. With the use of examples, define land use and rural landscapes and then comment on the assertion that 'landscapes in Africa are dynamic'.

3. Explain the role transport and mobile phone technologies are playing to promote rural livelihoods.

4. Account for the location of rural settlements in Africa.

5. Discuss four gender responsive approaches to rural development.

END OF EXAMINATION

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INSTITUTE OF DISTANCE EDUCATION

2022/2023 ACADEMIC YEAR FINAL EXAMINATIONS

GES 5121: URBAN GEOGRAPHY AND THE GLOBAL SOUTH

TIME: Three Hours.

INSTRUCTIONS: Answer any four questions. All questions carry equal marks.
                    Candidates are encouraged to use examples wherever appropriate.

1. Write short explanatory notes on all of the following concepts, giving practical examples from cities in the global South:
   a) Morphogenesis in Urban Geography,
   b) Urban labour markets,
   c) Green infrastructure,
   d) Four principal methods used to identify urban places,
   e) Pre-industrial era urbanisation.

2. 'Urban places are complex phenomena.' Elaborate.

3. Describe Louis Wirth's concept of urbanism.

4. Outline the importance of good governance to the management of cities.

5. 'Describe how the concept of 'edge cities' has affected the quality of urban life in the City of Lusaka.

6. 'Security of land tenure is necessary if land is to serve as a means of livelihood and as a vehicle for investment and wealth creation.' Critically review the land tenure system in Zambia with reference to informal settlements.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
INSTITUTE OF DISTANCE EDUCATION

2021/22 ACADEMIC YEAR FINAL EXAMINATIONS

GES 5142: POPULATION DYNAMICS AND DEVELOPMENT

TIME: Three Hours

INSTRUCTIONS: Answer question 1 and any other three questions. Use of an approved calculator is allowed. Candidates are encouraged to use illustrations wherever appropriate.

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1. Table 1 presents selected demographic characteristics for Country X in 2002.

   a) Calculate the following rates for Country X
      i. Crude Death Rate (CDR)
      ii. Age Specific Death Rates (ASDRs)
   b) Draw a line graph to show age pattern of mortality for the population in country X. Comment on the pattern

Table 1 Selected Demographic characteristics for Country X in 2002

Age	Population	Births	Deaths
0 <	9,938	0	55
1-4	38,503	0	12
5-9	50,400	0	6
10-14	57,216	1,150	24
15-19	56,634	1,315	43
20-24	42,929	4,340	63
25-34	84,112	5,670	120
35-44	107,305	4,995	280
45-54	103,039	24	427
55-64	52,543	0	480
65-74	24,096	0	502
75-84	11,784	0	645
85+	3,117	0	373
	641,616	17,494	3030

Source: Hypothetical

2. 'Migration can provide new opportunities to improve women's lives '. Discuss.

3. Discuss the relevance of the Demographic Transition Theory (DTT) for developing countries like Zambia.

4. 'Population policies are not relevant in the Twenty-First Century'. Discuss.

THE UNIVERSITY OF ZAMBIA

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2022/2023 ACADEMIC YEAR FINAL EXAMINATIONS

GES 5231: APPLIED HYDROLOGY

TIME: Three Hours

INSTRUCTIONS: Answer any four (4) questions. All questions carry equal marks.
Candidates are advised to make use of illustrations and examples
wherever appropriate.

1. Explain the major paradigmatic changes in Hydrological Sciences and show which period has been the most impactful on current thought in applied hydrology.

2. Using Hydro-informatics lenses, explain the pros and cons of Data Science, Machine Learning (ML) and Artificial Intelligence (AI) in hydrological sciences in Zambia.

3. Describe the runoff generation mechanism of Hortonian overland flow highlighting the nature of environments where it dominates.

4. Briefly explain each of the following concepts and show how they contribute to storm water management:
   a. Unit hydrograph theory
   b. Runoff coefficient
   c. Baseflow separation
   d. Systems approach in hydrology.

5. You have been asked to lead a team conducting discharge measurement on the ungauged Kafwamba River using the velocity area method.
   a) List the major equipment you would need and what parameters they would measure.
   b) Explain how you would conduct the discharge measurement.

6. (a) Draw and label a storm hydrograph.
   (b) Explain any five factors that influence the shape of storm hydrographs.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

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2022/2023 ACADEMIC YEAR FINAL EXAMINATIONS

GES 5271: CLIMATOLOGY

TIME: Three Hours

INSTRUCTIONS: Answer any **FOUR** questions. All questions carry equal marks.
                   Candidates are encouraged to make use of illustrations wherever
                   appropriate.

1. Explain the role of the five 'spheres' in the earth's climate system in shaping local climates.

2. Explain the physical laws governing the Earth's radiation budget involving both radiation from

   the sun and radiation from the Earth.

3. Use Newton's 2nd Law of motion and the law of mass continuity in fluids to describe how

   temperatures are regulated around areas near water bodies.

4. Explain the process of short-wave and longwave energy flow to and from the earth.

5. 'Climate change would still occur without anthropogenic causes.' Discuss this assertion using

   the Milankovitch theory of Earth's Orbital Cycles.

6. Explain how positive and negative feedbacks interact to avoid a runaway global climate change

   scenario.

END OF EXAMINATION

1

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE STUDIES

2019 ACADEMIC YEAR DEFERRED FINAL EXAMINATIONS

GES 5311: PRINCIPLES OF ENVIRONMENTAL & NATURAL RESOURCES MANAGEMENT

TIME: Three hours

INSTRUCTIONS: Answer any four questions. Candidates are encouraged to make use of illustrations whenever appropriate.

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1. Explain the concepts of environmental narratives and counter narratives.

2. Elucidate the conditions under which Dutch disease is likely to manifest.

3. Explain the main challenges associated with common property regimes.

4. Write short explanatory notes on **all** of the following:
    a) Tragedy of the commons.
    b) Women's triple gender roles in natural resources utilization.
    c) Property rights.
    d) Factors affecting collective action in CBNRM.
    e) Cornucopian arguments on natural resources scarcity.

5. Explain the pros and cons of community based natural resources management.

6. Boserup (1965) postulated that population growth drives agricultural innovation. Discuss.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE EDUCATION

2021/2022 ACADEMIC YEAR FINAL EXAMINATIONS

GES 5312: CONTEMPORARY BIOGEOGRAPHY

TIME: Three hours

INSTRUCTIONS: Answer four questions. Each questions carries equal marks. Candidates are encouraged to make use of illustrations wherever appropriate.

1 Write short explanatory notes on ALL the following :
   a) Bio-indicators for ecological and environmental monitoring
   b) Aims of contemporary biogeography
   c) Biogeography of fresh waters
   d) Niche concept in biogeography
   e) Ecosystem functions

2 Discuss the impact of invasive species on natural resources and the environment.

3. Explain the main causes of biodiversity loss and describe ways of protecting biodiversity.

4 With relevant examples, discuss three approaches to contemporary biogeography.

5 Describe how you can use quadrant method to estimate the number of individual organisms present and explain the importance of quadrat sampling.

6 Explain effects of climate change on species

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE EDUCATION

2021/2022 ACADEMIC YEAR FINAL YEAR EXAMINATIONS

GES 5315: TOURISM AND THE ENVIRONMENT

TIME:　　　　　Three hours

INSTRUCTIONS:　Answer four questions. Each questions carry equal marks. Candidates are encouraged to make use of illustrations wherever appropriate.

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1. Discuss the economic significance of tourism in Zambia, highlighting measures that can be put in place to stimulate its growth.

2. With relevant examples, explain how technological changes affect tourism.

3. Discuss the assertion by Leuterio(2007) that 'Natural and developed attractions are the 'mainspring' that drives many people to travel'.

4. Explain how tourism with environmental protection can be developed?

5. Discuss the paradox that 'tourism carries the seed of its own destruction.'

6. You have just been employed by the Ministry of Tourism and Arts as an environmental planner. Explain five policy suggestions you would employ to improve the tourism sector in Zambia?

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE EDUCATION

2021/2022 ACADEMIC YEAR FINAL EXAMINATIONS

GES 5325: ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS

TIME: Three Hours

INSTRUCTIONS: Answer Question 1 and any other three. Candidates are encouraged to use illustrations wherever appropriate. Use of an approved calculator is allowed. Discounting tables are provided.

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1. ZESCO currently generates 7000 KW of electricity annually which it sells at ZMW 0.7million per Kilowatt to Mungwi residents. Its annual maintenance costs are ZMW 2.2million. It would need to refurbish its turbines in 10 years at a cost of ZMW 10 million. Due to insufficient supply of electricity by ZESCO, some households have resorted to use of charcoal for cooking. An environmental economist has estimated the value of charcoal consumed to be worth ZMW1.6million and costs ZMW 3.3million in lost ecosystem services annually.

   The government of Zambia wants to set up a solar power plant in Mungwi district to generate 50 000 KW of electricity annually for a period of 20 years. The solar power plant will have initial costs of ZMW 150 million. The solar panels will need to be replaced after 15 years of operation at an estimated cost of ZMW 38 million. It will cost the government ZMW 12million annually to operate and maintain the plant. Each Kilowatt of electricity will be sold for ZMW1million. The solar power plant will bring an end to charcoal production.

   a) Conduct a cost benefit analysis and advise the government on what it should do. Assume a discount rate of 10%.
   b) Conduct a sensitivity analysis to predict what would happen to the ZESCO option if due to climate change, electricity generation dropped to 30 000KW annually. Would this change the conclusion you made in (a)?
   c) Why is it important to conduct a sensitivity analysis?

2. Discuss how taxes could be used as an economic instrument to lower fish harvest levels in publicly managed fisheries.

1

3. Explain the advantages and challenges of applying the hedonic valuation for determining environmental quality in a developing country.

4. Discuss challenges associated with water governance in Zambia and suggest options for addressing them.

5. The newly constituted National Charcoal Taskforce intends to assess implications of a policy intending to ban charcoal production in Zambia. As an expert in Environmental Management and Planning outline possible positive and negative implications that you can provide to the taskforce.

6. Explain five green financing mechanisms available for countries like Zambia

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE EDUCATION

2021/2022 ACADEMIC YEAR FINAL EXAMINATIONS

GES 5332: ENVIRONMENTAL MANAGEMENT AND PLANNING

TIME: Three hours

INSTRUCTIONS: Answer any four questions. Each question carries equal marks. Candidates are encouraged to use appropriate illustrations whenever possible.

1. Describe key elements of the Environmental Impact Assessment (EIA) and benefits of integrating EIA in environmental planning.

2. Discuss five major constraints to environmental sustainability and propose the possible interventions to offset them.

3. Principles of good governance are essential in the management of natural resources at various levels of society in Zambia. Explain with examples how this can be achieved if the country is to manage the natural resources sustainably.

4. In a housing development project at the University of Zambia predict four possible impacts that may occur, stating the nature of the impacts and their mitigation measures.

5. ZEMA requires an Environmental Project Brief (EPB) for the construction and operation of a fuel service station from a developer.

   a) List four other projects that may require an EPB
   b) Give an account of important issues that must be considered for inclusion in an EPB.

6. A Life Cycle Assessment process is a critical methodology for assessing potential environmental impacts of products, activities, or services during the entire life cycle. Discuss the main stages of the Life cycle assessment.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE EDUCATION

2021/2022 ACADEMIC YEAR FINAL YEAR EXAMINATIONS

GES 5355: POLITICAL ECOLOGY AND ENVIRONMENTAL GOVERNANCE

TIME: Three Hours

INSTRUCTIONS: Answer any four questions. Each question carries equal marks. Candidates are encouraged to use appropriate illustrations whenever possible.

1. Garett Hardin's Tragedy of the Commons thesis guided environmental conservation for several decades after its publication in 1968. Explain how this meta-narrative fits into political ecology's conservation and control thesis.

2. Use an example from any natural resources sector to differentiate political ecology from apolitical ecology.

3. Discuss various forms of power relations that drive the continued existence of informal settlements in urban areas like Lusaka.

4. To what extent do you think the creation of the Ministry of Local Government and Rural Development and devolution of Constituency Development Fund is likely to translate into improved local environmental governance?

5. 'Both international and local non state actors in the environmental sector have failed to demonstrate sustainable poverty reduction to local communities adjacent to natural resources that they have been heavily funding for decades.' Discuss.

6. Explain the value of structuralist theory to the study of social, ecological and political systems.

END OF EXAMINATION

1

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE EDUCATION

2019/2020 ACADEMIC YEAR DIFFERED EXAMINATIONS

GES 5365: CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

TIME: Three Hours

INSTRUCTIONS: Answer any **FOUR** questions. All questions carry equal marks. Candidates are encouraged to make use of illustrations wherever appropriate.

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1. Explain how each of the components of the Earth's climate system affect global climates.

2. 'The Paris Climate Change Agreement of 2015 is a more effective legal agreement at combating impacts of climate change than the Kyoto Protocol'. Discuss.

3. Explain how smallholder agriculture in Zambia can be adapted to combat impacts of climate change.

4. Carbon dioxide is one of the greenhouse gases and it contributes about 60% of the enhanced greenhouse effect. Briefly explain the mitigation options for this gas (CO_2).

5. Discuss the challenges that developing country party delegations face at the Conference of Parties (COPs) during climate change negotiations, and suggest ways in which some of the challenges could be addressed.

6. Using Zambia as an example, explain why climate change is a curse or blessing to the tourism sector.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA
INSTITUTE OF DISTANCE EDUCATION

2019/2020 ACADEMIC YEAR DEFERRED EXAMINATIONS

GES 5375: FORESTS AND WILDLIFE MANAGEMENT

TIME: Three Hours

INSTRUCTIONS: Answer any FOUR questions. All questions carry equal marks. Candidates are encouraged to make use of illustrations wherever appropriate.

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1. Write explanatory notes on ALL of the following:

    (a) The importance of wildlife to the economy of a country like Zambia

    (b) The impact of human – wildlife conflict on natural systems

    (c) Biodiversity management strategies in southern Africa

    (d) Community – Based Wildlife Management in southern Africa

    (e) The content of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

2. What is sustainable forest management andexplain the strategies for attaining it.

3. 'In spite of the various conservation measures being taken by the authorities, the poachers have continued to either destroy or capture wild animals for a number of reasons'. Elucidate.

4. How can deforestation be avoided in forests adjacent to communities with socio-economic problems?

5. Identify any five threatened wild animal species in southern Africa and for each one of them explain the causes for its threat.

6. Discuss the nexus between forests and climate change.

END OF EXAMINATION

THE UNIVERSITY OF ZAMBIA

INSTITUTE OF DISTANCE EDUCATION

2021/2022 ACADEMIC YEAR FINAL YEAR EXAMINATIONS

GES 5410: RESEARCH METHODOLOGY

TIME: Three hours

INSTRUCTIONS: Answer any two questions from section A and any two questions from section B. Each question carries equal marks. Candidates are encouraged to use illustrations wherever possible. Use of an approved calculator is allowed. Formulae sheets and critical tables are provided.

Section A

1. Using an example from any natural resources sector, contrast how you would conduct two studies using positivism and constructivism as ontology positions in terms of the following:

   a) Sampling method

   b) Research design

   c) Positionality of the researcher

   d) Data analysis

   e) Generalization of results and conclusions

2. Explain how you would conduct a systematic literature review.

3. Explain the significance of the following

   a) Theoretical framework

   b) Problem statement

   c) Data cleaning

   d) Pre-testing

   e) Ethical obligations

Section B

4. Malele undertook a study to determine factors influencing usage of tablets. He carried out a statistical analysis in Minitab and got the following outputs (table 1):

Table 1: Analysis of factors influencing usage of tablets

Response Information

Variable	Value	Count
Tablet usage	Yes	46 (Event)
	NO	129
	Total	175

Odds Ratios for Categorical Predictors (Odds ratio for level A relative to level B)

Level A	Level B	Odds Ratio	95% CI
Sex			
Male	Female	0.4534	(0.0982, 2.0933)
Marital status			
Married	Divorced	6.8658	(0.3896, 121.0033)
Single	Divorced	32.4255	(1.4318, 734.3288)
Widowed	Divorced	8.3557	(0.2110, 330.9324)
Single	Married	4.7227	(0.8947, 24.9287)
Widowed	Married	1.2170	(0.0859, 17.2373)
Widowed	Single	0.2577	(0.0150, 4.4285)

Coefficients table

Term	Coef	SE Coef	Z-Value	P-Value	VIF
Constant	-3.90	1.98	-1.97	0.049	
Monthly income	0.001083	0.000280	3.86	0.000	1.84
Level of education	0.125	0.119	1.05	0.294	1.87
Household size	-0.175	0.159	-1.10	0.270	1.10
Age of household head	-0.0383	0.0286	-1.34	0.180	1.32
Sex					
Male	-0.791	0.781	-1.01	0.311	1.51
Marital status					
Married	1.93	1.46	1.32	0.188	5.47
Single	3.48	1.59	2.19	0.029	4.56
Widowed	2.12	1.88	1.13	0.258	2.88

Goodness-of-Fit Tests

Test	DF	Chi-Square	P-Value
Deviance	166	84.05	1.000
Pearson	166	166.48	0.475
Hosmer-Lemeshow	8	4.74	0.785

Using information in table 1 answer the following questions:

a) Identify the test that Malele used and write the hypothesis

b) Interpret the results shown in the coefficient table

c) State the conclusions

d) Explain the meaning of the odds ratio associated with sex and the single-marital status

e) Explain conditions under which a chi-square test can be done

5. A researcher conducts a Two Independent Sample T-Test to determine whether or not there are differences in the mean ages of men and women taking part in a climate adaptation training. The results are shown in Table 2.

2

Table 2: Two Independent Sample T-Test

Two-Sample T-Test and CI: Age of respondent, Gender

Method

μ_1: mean of Age of respondent when Gender = f

μ_2: mean of Age of respondent when Gender = m

Difference: $\mu_1 - \mu_2$

Equal variances are assumed for this analysis.

Descriptive Statistics: Age of respondent

Gender	N	Mean	StDev	SE Mean
female	171	45.11	9.62	0.74
male	125	48.9	10.9	0.98

Estimation for Difference

Difference	Pooled StDev	95% CI for Difference
-3.78	10.18	(-6.14, -1.42)

Test

Null hypothesis $H_0: \mu_1 - \mu_2 = 0$

Alternative hypothesis $H_1: \mu_1 - \mu_2 \neq 0$

T-Value	DF	P-Value
-3.16	294	0.002

a) State the hypotheses for the test

b) What decision did the researcher make concerning the hypotheses? Provide evidence for your answer.

c) What was the researcher's conclusion?

d) The researcher wanted to compare the mean age of the male participants in the training to the district average of 56.7 years. Show how a one tailed analysis for this test could be conducted.

6. A researcher is interested in knowing whether income levels affect residents' participation in community development projects. She collects information from five different residential areas, categorized by economic status their residents. She wants to

confirm her assumption that the income levels in the four residential areas are different before she examines their residents' participation levels. She therefore starts by running an ANOVA test. The data are summarized in Tables 3 and 4.

Table 3: One-way ANOVA: Income (ZMW) versus Residential area

Source of variation	Degrees of Freedom	Sum of Squares	Mean Square	F ratio
Residential area	3	7375782		
Error		27255053		
Total	57	34630835		

Table 4. Descriptive statistics for the four residential areas

```
                              Individual 95% CIs For Mean Based on
                              Pooled StDev
Level    N     Mean    StDev    -+---------+---------+---------+--------
A        10   3031.4  1108.9       (--------*-------)
B        12   3749.5  1101.6                    (-------*-------)
C        15   2988.2   385.7     (--------*------)
D        21   2783.4   194.4   (------*-----)
                                 -+---------+---------+---------+--------
                               2500      3000      3500      4000

Pooled StDev = 710.4
```
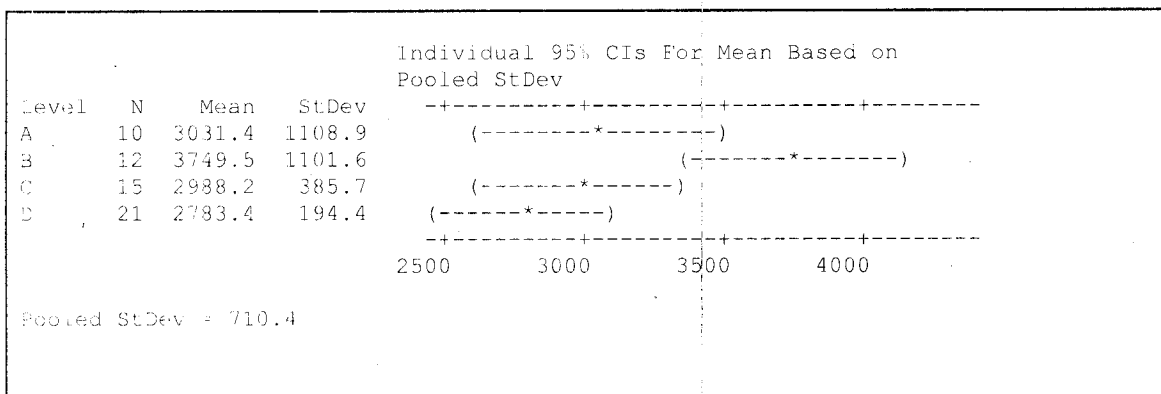
e) State the three assumptions necessary for the analysis of variance of the data.

f) Copy the following ANOVA table (Table 3) into your answer script and complete it.

g) Test the researcher's hypothesis about differences in the income levels among the four residential areas.

h) The researcher interviews more households from residential areas A and C to determine their levels of participation in community development activities. She finds that in Area A, 215 residents out of a total population of 1300 participate, while in Area C, 357 residents out of total area population of 1700 take part. Are the levels of participation in residential area A lower than in residential area C? (Assume $\alpha = 0.05$).

END OF EXAMINATION

TABLE 6 (Continued)

$$\alpha = .05$$

$F_\alpha(v_1, v_2)$
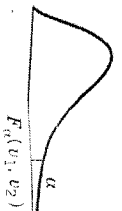
| v_2 \ v_1	1	2	3	4	5	6	7	8	9	10	12	15	20	25	30	40	60
1	161.5	199.5	215.7	224.6	230.2	234.0	236.8	238.9	240.5	241.9	243.9	246.0	248.0	249.3	250.1	251.1	252.2
2	18.51	19.00	19.16	19.25	19.30	19.33	19.35	19.37	19.38	19.40	19.41	19.43	19.45	19.46	19.46	19.47	19.48
3	10.13	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.74	8.70	8.66	8.63	8.62	8.59	8.57
4	7.71	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.91	5.86	5.80	5.77	5.75	5.72	5.69
5	6.61	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.68	4.62	4.56	4.52	4.50	4.46	4.43
6	5.99	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	4.00	3.94	3.87	3.83	3.81	3.77	3.74
7	5.59	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.57	3.51	3.44	3.40	3.38	3.34	3.30
8	5.32	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.28	3.22	3.15	3.11	3.08	3.04	3.01
9	5.12	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.07	3.01	2.94	2.89	2.86	2.83	2.79
10	4.96	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.91	2.85	2.77	2.73	2.70	2.66	2.62
11	4.84	3.98	3.59	3.36	3.20	3.09	3.01	2.95	2.90	2.85	2.79	2.72	2.65	2.60	2.57	2.53	2.49
12	4.75	3.89	3.49	3.26	3.11	3.00	2.91	2.85	2.80	2.75	2.69	2.62	2.54	2.50	2.47	2.43	2.38
13	4.67	3.81	3.41	3.18	3.03	2.92	2.83	2.77	2.71	2.67	2.60	2.53	2.46	2.41	2.38	2.34	2.30
14	4.60	3.74	3.34	3.11	2.96	2.85	2.76	2.70	2.65	2.60	2.53	2.46	2.39	2.34	2.31	2.27	2.22
15	4.54	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.48	2.40	2.33	2.28	2.25	2.20	2.16
16	4.49	3.63	3.24	3.01	2.85	2.74	2.66	2.59	2.54	2.49	2.42	2.35	2.28	2.23	2.19	2.15	2.11
17	4.45	3.59	3.20	2.96	2.81	2.70	2.61	2.55	2.49	2.45	2.38	2.31	2.23	2.18	2.15	2.10	2.06
18	4.41	3.55	3.16	2.93	2.77	2.66	2.58	2.51	2.46	2.41	2.34	2.27	2.19	2.14	2.11	2.06	2.02
19	4.38	3.52	3.13	2.90	2.74	2.63	2.54	2.48	2.42	2.38	2.31	2.23	2.16	2.11	2.07	2.03	1.98
20	4.35	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.28	2.20	2.12	2.07	2.04	1.99	1.95
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.25	2.18	2.10	2.05	2.01	1.96	1.92
22	4.30	3.44	3.05	2.82	2.66	2.55	2.46	2.40	2.34	2.30	2.23	2.15	2.07	2.02	1.98	1.94	1.89
23	4.28	3.42	3.03	2.80	2.64	2.53	2.44	2.37	2.32	2.27	2.20	2.13	2.05	2.00	1.96	1.91	1.86
24	4.26	3.40	3.01	2.78	2.62	2.51	2.42	2.36	2.30	2.25	2.18	2.11	2.03	1.97	1.94	1.89	1.84
25	4.24	3.39	2.99	2.76	2.60	2.49	2.40	2.34	2.28	2.24	2.16	2.09	2.01	1.96	1.92	1.87	1.82
26	4.23	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.15	2.07	1.99	1.94	1.90	1.85	1.80
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.31	2.25	2.20	2.13	2.06	1.97	1.92	1.88	1.84	1.79
28	4.20	3.34	2.95	2.71	2.56	2.45	2.36	2.29	2.24	2.19	2.12	2.04	1.96	1.91	1.87	1.82	1.77
29	4.18	3.33	2.93	2.70	2.55	2.43	2.35	2.28	2.22	2.18	2.10	2.03	1.94	1.89	1.85	1.81	1.75
30	4.17	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.09	2.01	1.93	1.88	1.84	1.79	1.74
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.08	2.00	1.92	1.84	1.78	1.74	1.69	1.64
60	4.00	3.15	2.76	2.53	2.37	2.25	2.17	2.10	2.04	1.99	1.92	1.84	1.75	1.69	1.65	1.59	1.53
120	3.92	3.07	2.68	2.45	2.29	2.18	2.09	2.02	1.96	1.91	1.83	1.75	1.66	1.60	1.55	1.50	1.43
∞	3.84	3.00	2.61	2.37	2.21	2.10	2.01	1.94	1.88	1.83	1.75	1.67	1.57	1.51	1.46	1.39	1.32

TABLE 5 Percentage Points of χ^2 Distributions
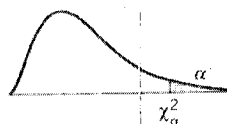
α d.f.	.99	.975	.95	.90	.50	.10	.05	.025	.01
1	.0002	.001	.004	.02	.45	2.71	3.84	5.02	6.63
2	.02	.05	.10	.21	1.39	4.61	5.99	7.38	9.21
3	.11	.22	.35	.58	2.37	6.25	7.81	9.35	11.34
4	.30	.48	.71	1.06	3.36	7.78	9.49	11.14	13.28
5	.55	.83	1.15	1.61	4.35	9.24	11.07	12.83	15.09
6	.87	1.24	1.64	2.20	5.35	10.64	12.59	14.45	16.81
7	1.24	1.69	2.17	2.83	6.35	12.02	14.07	16.01	18.48
8	1.65	2.18	2.73	3.49	7.34	13.36	15.51	17.53	20.09
9	2.09	2.70	3.33	4.17	8.34	14.68	16.92	19.02	21.67
10	2.56	3.24	3.94	4.87	9.34	15.99	18.31	20.48	23.21
11	3.05	3.81	4.57	5.58	10.34	17.28	19.68	21.92	24.72
12	3.57	4.40	5.23	6.30	11.34	18.55	21.03	23.34	26.22
13	4.11	5.01	5.89	7.04	12.34	19.81	22.36	24.74	27.69
14	4.66	5.62	6.57	7.79	13.34	21.06	23.68	26.12	29.14
15	5.23	6.26	7.26	8.55	14.34	22.31	25.00	27.49	30.58
16	5.81	6.90	7.96	9.31	15.34	23.54	26.30	28.85	32.00
17	6.41	7.56	8.67	10.09	16.34	24.77	27.59	30.19	33.41
18	7.01	8.23	9.39	10.86	17.34	25.99	28.87	31.53	34.81
19	7.63	8.90	10.12	11.65	18.34	27.20	30.14	32.85	36.19
20	8.26	9.59	10.85	12.44	19.34	28.41	31.41	34.17	37.57
21	8.90	10.28	11.59	13.24	20.34	29.62	32.67	35.48	38.93
22	9.54	10.98	12.34	14.04	21.34	30.81	33.92	36.78	40.29
23	10.20	11.69	13.09	14.85	22.34	32.01	35.17	38.08	41.64
24	10.86	12.40	13.85	15.66	23.34	33.20	36.42	39.36	42.98
25	11.52	13.11	14.61	16.47	24.34	34.38	37.65	40.65	44.31
26	12.20	13.84	15.38	17.29	25.34	35.56	38.89	41.92	45.64
27	12.88	14.57	16.15	18.11	26.34	36.74	40.11	43.19	46.96
28	13.56	15.30	16.93	18.94	27.34	37.92	41.34	44.46	48.28
29	14.26	16.04	17.71	19.77	28.34	39.09	42.56	45.72	49.59
30	14.95	16.78	18.49	20.60	29.34	40.26	43.77	46.98	50.89
40	22.16	24.42	26.51	29.05	39.34	51.81	55.76	59.34	63.69
50	29.71	32.35	34.76	37.69	49.33	63.17	67.50	71.42	76.15
60	37.48	40.47	43.19	46.46	59.33	74.40	79.08	83.30	88.38
70	45.44	48.75	51.74	55.33	69.33	85.53	90.53	95.02	100.43
80	53.54	57.15	60.39	64.28	79.33	96.58	101.88	106.63	112.33
90	61.75	65.64	69.13	73.29	89.33	107.57	113.15	118.14	124.12
100	70.06	74.22	77.93	82.36	99.33	118.50	124.34	129.56	135.81

TABLE 3 Standard Normal Probabilities

$P[Z < z]$
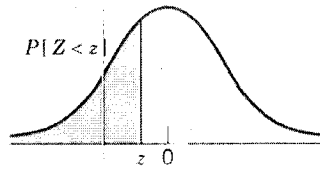
z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.5	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−.7	.2420	.2389	.2358	.2327	.2297	.2266	.2236	.2206	.2177	.2148
−.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

TABLE 3 (Continued)

$P[Z \le z]$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7703	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998
3.5	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998	.9998

Critical Values of Student's t

Degrees of freedom	Significance level (one-tailed)				
	0.05	0.025	0.01	0.005	0.0005
	Significance level (two-tailed)				
	0.1	0.05	0.02	0.01	0.001
1	6.31	12.71	31.82	63.66	636.62
2	2.92	4.30	6.97	9.93	31.60
3	2.35	3.18	4.54	5.84	12.92
4	2.13	2.78	3.75	4.60	8.61
5	2.01	2.57	3.37	4.03	6.86
6	1.94	2.45	3.14	3.71	5.96
7	1.89	2.37	3.00	3.50	5.41
8	1.86	2.31	2.90	3.35	5.04
9	1.83	2.26	2.82	3.25	4.78
10	1.81	2.23	2.76	3.17	4.59
11	1.80	2.20	2.72	3.11	4.44
12	1.78	2.18	2.68	3.05	4.32
13	1.77	2.16	2.65	3.01	4.22
14	1.76	2.15	2.62	2.98	4.14
15	1.75	2.13	2.60	2.95	4.07
16	1.75	2.12	2.58	2.92	4.01
17	1.74	2.11	2.57	2.90	3.97
18	1.73	2.10	2.55	2.88	3.92
19	1.73	2.09	2.54	2.86	3.88
20	1.73	2.09	2.53	2.85	3.85
21	1.72	2.08	2.52	2.83	3.82
22	1.72	2.07	2.51	2.82	3.79
23	1.71	2.07	2.50	2.81	3.77
24	1.71	2.06	2.49	2.80	3.75
25	1.71	2.06	2.49	2.79	3.73
26	1.71	2.06	2.48	2.78	3.71
27	1.70	2.05	2.47	2.77	3.69
28	1.70	2.05	2.47	2.76	3.67
29	1.70	2.05	2.46	2.76	3.66
30	1.70	2.04	2.46	2.75	3.65
40	1.68	2.02	2.42	2.70	3.55
60	1.67	2.00	2.39	2.66	3.46
120	1.66	1.98	2.36	2.62	3.37
∞	1.65	1.96	2.33	2.58	3.29

Reject H_0 if calculated value of t is **greater than** the critical value at the chosen significance level

STATISTICAL FORMULAE

$$T = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$T = \frac{\bar{x}_1 - \bar{x}_2}{S_p \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$T = \frac{|\bar{d}|}{S_d / \sqrt{n}}$$

$$S_p = \sqrt{\frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}}$$

$$Z = \frac{\hat{p} - p_o}{\sqrt{\frac{p_o(1 - p_o)}{n}}}$$

$$Z = \frac{p_1 - p_2}{\sqrt{\hat{p}(1 - \hat{p})} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

$$F = \frac{MS_{between\ treatments}}{MS_{error}}$$

$$\hat{p} = \frac{x + y}{n_1 + n_2}$$

$$x^2 = \frac{(O - E)^2}{E}$$

$$S_d = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

THE UNIVERSITY OF ZAMBIA
SCHOOL OF NATURAL SCIENCES
DEPARTMENT OF GEOGRAPHY AND ENVIRONMENTAL STUDIES

2021/22 ACADEMIC YEAR FINAL EXAMINATIONS
GES 5422: GIS AND REMOTE SENSING

TIME: Three Hours

INSTRUCTIONS: Answer question one and any other three (3). All questions carry equal marks. Candidates are advised to make use of illustrations and examples wherever appropriate.

1. Write short explanatory notes on ALL the following:

   (a) Rationale for remote sensing.

   (b) Fundamental challenges of remote sensing.

   (c) Two main types of energy sources in remote sensing.

   (d) Specific requirements needed to represent the geographical phenomenon in GIS.

   (e) The six components of the GIS processes.   **[20]**

2. Suitability analysis is very important in GIS as it is used to determine the best place or suitable site by combining multiple maps. Explain how you would conduct a suitability analysis for the location of a hospital.   **[20]**

3. Compare and contrast the following:

   (a) A model and spatial data modelling.

   (b) Raster and vector data structure, stating their advantages and disadvantages.

   (c) Buffering and overlay.

   (d) Projected coordinate system (PCS) and geographic coordinate systems (GCS).   **[20]**

4. 'In remote sensing, before radiation reaches the earth's surface, it must travel through some distance of the earth's atmosphere. Particles and gases in the atmosphere can affect the incoming light and radiation'. Elaborate.   **[20]**

5. Feature manipulation is a GIS operation that helps in the extraction and transformation of spatial data. Explain any four operations under feature manipulation. **[20]**

6. Describe the four process involved in map making **[20]**

END OF EXAMINATION