UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

B.Sc. DEGREE IN ENVIRONMENTAL HEALTH SCIENCE

MAIN EXAMINATION PAPER 2016

TITLE OF PAPER	: RESEARCH METHODS
COURSE CODE	: EHM 308
DURATION	: 2 HOURS
MARKS	: 100
INSTRUCTIONS	: READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	: ANSWER **ANY FOUR** QUESTIONS
	: EACH QUESTION **CARRIES 25** MARKS.
	: WRITE NEATLY & CLEARLY
	: NO PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
	: BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR.

QUESTION ONE (5 Marks each)

1A. Research studies are often undertaken based on sampling of a population. Discuss the reason for adopting sampling instead of studying the whole population. State also the steps that can be taken to minimize sampling errors.

1B. Describe the difference between validity and reliability in research. Explain how you are able to ensure validity in research.

1C. The letter grade on a test is to the _____scale of measurement and height is to the _____ scale of measurement:

i. Ordinal; ratio
ii. Ordinal; nominal
iii. Nominal; interval
iv. Interval; ratio

1D. List the advantages and disadvantages of case control studies.

1E. A researcher adopts a Latin square design on a given plot in order to study the influence of different types of fertilizers on the yield of different types of plants. For this study, he chose three different types fertilizers. For the plants, he chooses four plants, namely, spinach, beetroot, lettuce and green pepper. Draw a possible Latin square design for the experimental plots using your own notation for each factor. There are nine (3 X 3) plots on which the different fertilizers will be tried (one type of fertilizer per plot). Within each plot there are 16 (4 X 4) sub plots on which the different types of plants will be grown.

QUESTION TWO (5 Marks each)

2A. Explain the difference between confidentiality and anonymity in ethical consideration of research. Give examples separately in each case how you would ensure confidentiality as well as anonymity.

2B. Compare exploratory and descriptive research designs in terms of:

i. Overall design
ii. Sampling design
iii. Statistical design
iv. Observational design
v. Operational design

2C. Categorise each of the following types of research as either positivist or phenomenological:

i. Ethnography
ii. Experimental studies
iii. Surveys
iv. Case studies

2D. Researchers need to adopt '*active approach*' in literature review rather than a *passive approach*. List and explain the approach you will adopt to literature review part of your research in order to exploit the existing knowledge resources actively.

2E.. Under what circumstances would you recommend:

i. A probability sample?
ii. A non-probability sample?
iii. A stratified sample?
iv. A cluster sample?

QUESTION THREE

3A. Plate count of coliforms often results in widely varying number of plate counts among different sample repetition. What type of measure of central tendency would you recommend to calculate the average plate count? .....[5 marks]

3B. A researcher is conducting a survey of student opinion of the dining hall at a university. The researcher decided to conduct his survey by using every tenth name on the Registrar's alphabetical list of all students at his school. The type of sampling that the researcher is using is:

i. Representative cluster sampling
ii. Cluster sampling
iii. Stratified random sampling
iv. Simple, random sampling
v. Systematic random sampling .....[5 marks]

3C. Fill in the missing information in the following table representing performance on an exam that is normally distributed with mean of 68 and standard deviation of 15. Use the z score table provided with this question paper. .....[15 marks]

	Exam score	Z score	Percentile rank
Student A	75	?	?

QUESTION FOUR

The table below shows the exam score of eleven students in a given class for two subjects.

4A. Calculate the correlation coefficient and coefficient of determination between the scores for these two subjects. .....[10 marks]

4B. Write the regression equation for the prediction of the score for subject B from the scores available for subject A. .....[8 marks]

4C. If a student in the class scores 30 for subject A, what will most probably be the exam score for subject B for this particular student? ...[7 marks]

Student	Exam score for Subject A	Exam score for Subject B
1	40	54
2	57	75
3	89	99
4	67	81
5	72	87
6	57	73
7	75	97
8	66	81
9	53	65
10	77	96
11	62	78

QUESTION FIVE (25 marks)

5A. How do you characterize Type I error and type II error with respect to hypothesis testing? Is the attempt to minimize type I error likely to increase the type II error and vice versa? .....[5 marks]

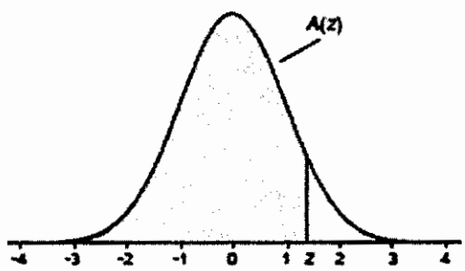
5B. What mechanism can be employed to minimize type I error? .....[5 marks]

5C. A researcher wanted to identify the performance of students in a college as average, above average and below average. For this purpose he wants to take a sample of students performance with adequate number of samples so that the average mark calculated from the sample is accurate ± 5 marks from the true average with 95% confidence limits. The standard deviation of students marks is known to be 15 marks. Determine the minimum number of samples needed assuming that the samples are normally distributed. .....[7 marks]

5D. A regular monitoring test of a given heavy metal on an industrial waste water effluent gave a value of 12 µg/L. The number of repetition measurements was 6. The standard deviation has been established as 1µg/L. If the maximum effluent limit for the heavy metal was 10µg/L, determine whether there is significant difference between the measured concentration and the effluent limit. Use the critical t table provided below. .....[8 marks]

t Distribution: Critical Values of t

		Significance level					
Degrees of freedom	*Two-tailed test:*	10%	5%	2%	1%	0.2%	0.1%
	One-tailed test:	5%	2.5%	1%	0.5%	0.1%	0.05%
1		6.314	12.706	31.821	63.657	318.309	636.619
2		2.920	4.303	6.965	9.925	22.327	31.599
3		2.353	3.182	4.541	5.841	10.215	12.924
4		2.132	2.776	3.747	4.604	7.173	8.610
5		2.015	2.571	3.365	4.032	5.893	6.869
6		1.943	2.447	3.143	3.707	5.208	5.959
7		1.894	2.365	2.998	3.499	4.785	5.408
8		1.860	2.306	2.896	3.355	4.501	5.041
9		1.833	2.262	2.821	3.250	4.297	4.781
10		1.812	2.228	2.764	3.169	4.144	4.587
11		1.796	2.201	2.718	3.106	4.025	4.437
12		1.782	2.179	2.681	3.055	3.930	4.318
13		1.771	2.160	2.650	3.012	3.852	4.221
14		1.761	2.145	2.624	2.977	3.787	4.140
15		1.753	2.131	2.602	2.947	3.733	4.073



$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							