AMREF INTERNATIONAL TRAINING CENTER

Qualification Code	**:**	**102106T4COH**
Qualification	**:**	**Community Health Level 5**
Unit Code	**:**	**AITC/CH/CC/01/5/B**
Unit of Competency	**:**	**Apply Statistics in Community Health**

WRITTEN ASSESSMENT

Time: 3 HOURS

INSTRUCTION TO CANDIDATE

1. Marks for each question are indicated in the brackets
2. This paper consists of **TWO** sections: **A** and **B**
3. Candidates are provided with a separate answer booklet
4. **DO NOT** write on this question paper

This paper consists of ELEVEN (11) printed pages

Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing.

SECTION A: (40 MARKS)

*Answer **all** questions in this section.*

1. Define the following terms as used in statistics.
   i) Standard normal distribution (2 Marks)
   ii) Z - Score (2 Marks)
   iii) Parameter (2 Marks)
2. Differentiate the following terms.
   i) Descriptive statistics and inferential statistics. (2 Marks)
   ii) Population and Sample (2 Marks)
   iii) Sample survey and census (2 Marks)
3. In Kipsongo in 2024, the total population was 40,412. Of these 3386 were aged under 5 years or 0-4 years. Calculate the proportion of the population aged 0-4 years in 2015. (2 Marks)
4. Explain the difference between mean deviation and standard deviation (3 Marks)
5. Find the harmonic mean of the following dataset. (3 Marks)

Age	5	7	10	11
Frequency	10	6	3	1

6. Consider a hospital emergency department where patients arrive according to a Poisson process at an average rate of 2 patients per minute. Determine the probability that in any one-minute interval:
   i) No patients arrive. (2 Marks)
   ii) Exactly 3 patients arrive. (2 Marks)
7. State and explain the scales of measurements giving an example in each case. (4 Marks)
8. Outline FOUR conditions of a Probability. (4 Marks)
9. Given that events A and B are independent, find $P(A \cap B)$ if $P(A) = 0.3$ and $P(B) = 0.012$ and hence find $P(A \cup B)$. (3 Marks)
10. A hospital with 210 available beds in June recorded 4780 patient days and had 736 discharged patients. Calculate the bed turnover interval. (3 Marks)

11. At an outpatient testing center, the number of cardiograms performed each day for 20 days is shown. Construct a Box and Whisker Plot for the data and identify any potential outlier.
18, 34, 76, 29, 15, 41, 46, 25, 54, 38, 20,32, 43, 22 (3 Marks)

SECTION B: (60 MARKS)

Answer any THREE questions in this section

12.

a) A supervisor decided to track the productivity of two employees, Daniel and Juma. On five randomly selected weeks, the number of completed reports by the employees were summarized in the table below.

Employee	Completed reports				
Daniel	15	5	10	25	20
Juma	10	20	20	10	15

i) Determine the sample variance for each employee. (6 Marks)

ii) Which employee is more productive? Give a reason. (2 Marks)

b) As part of a project evaluating the sustainability of community-based health enterprises (CBHEs), the County Department of Health collected data on the capital size (in millions of Kenyan Shillings) of 285 registered CBHEs. The capital was grouped into classes as shown below:

Capital Range (in millions KSh)	1 - 5	6-10	11-15	16-20	21-25	26-30	31-35
Number of CBHEs	20	27	29	38	48	53	70

Compute Bowley's and Kelly's coefficient of skewness and interpret the results in the context of the capital distribution of CBHEs. (8 Marks)

c) During a cardiovascular screening program conducted by Amref Health Africa, it was found that pulse rates of adult men are approximately normally distributed with a mean of 70 and standard deviation of 8. Based on this information, calculate the probability that a randomly selected adult male will have a pulse rate that:

i) Less than 72. (2 Marks)

ii) Between 64 and 76. (2 Marks)

13.

a) A hospital with 50 beds available during the year 2024 had 21,500 Occupied Bed Days. It discharged 650 patients during the year. A number of patients slept on the floor because beds were less than daily average population. Calculate

i) The number of beds that would be required in order to accommodate all patients on beds. (2 Marks)

ii) Percentage Occupancy. (2 Marks)

iii) Average length of stay. (2 Marks)

iv) Daily average occupancy. (2 Marks)

b) A discrete random variable Y has a PMF (Probability Mass Function) given by the table below:

y	0	1	2	3	4
P(Y=y)	c	2c	5c	10c	17c

Find the value of the constant c hence compute P(1<Y<3). (3 Marks)

c) An important part of a community health center's service is the speed at which the health department can respond to reported waterborne disease cases. Past records show that 70% of reported cases can be successfully managed within a day. For the first three cases reported on a given day, determine the probability that:

i) Exactly three cases will be successfully managed within the same day. (2 Marks)

ii) Fewer than two cases will be successfully managed within the same day.

(2 Marks)

d) The following table shows the distribution of systolic blood pressure (in mmHg) recorded for a group of patients during a health screening exercise:

Systolic Blood Pressure (mmHg)	100-104	105-109	110-114	115-119	120-124	125-129	130-134
Number of patients.	2	8	18	13	7	1	1

Construct a cumulative frequency curve (ogive) and a histogram to represent this data.

(5 Marks)

14.

a) The following data were collected during a community health survey assessing malaria control in Kakamega County. The table shows the number of mosquito nets owned per household (X) and the corresponding number of malaria cases reported in the household over six months (Y).
Develop a regression equation that can be used to predict the number of malaria cases based on the number of mosquito nets in a household. (8 Marks)

Household (ID)	1	2	3	4	5	6	7	8	9	10
Mosquito Nets Owned (x)	98	66	100	96	88	45	76	60	74	82
Malaria Cases in 6 Months (y)	90	74	98	88	80	62	78	74	86	80

b) As part of a community health survey, Amina, a community health officer, collected data on households' health awareness scores (rated from 0 to 100). The scores were grouped as follows:

Health Score Range	Number of Households (f)
50-59	3
60-69	5
70-79	9
80-89	12
90-100	8

Using the data, calculate the following measures to assist Amina in evaluating the overall health awareness of the community:

i) Mean health awareness score. (3 Marks)
ii) Variance. (4 Marks)
iii) Standard deviation. (2 Marks)
iv) Coefficient of variation. (3 Marks)

15.

a) The Finance division of a large company is investigating its procedures for the selection of new accountancy trainees. Potential applicants are given prior to appointment both a written test and formal interview. The performances of eight successful applicants were rated after their first full year with the company. The independent rankings of written test, interview assessment and job performance for the eight trainees are given as follows. (1=best, 2= second best etc)

Trainee	A	B	C	D	E	F	G	H
Written test	6	2	7	4	1	5	3	8
Interview	1	4	2	3	6	5	8	7
Job Performance	1	2	3	4	5	6	7	8

You are required to:

i) Calculate the rank correlation coefficient between (Job performance and written test) and (job performance and interview assessment) (8 Marks)

ii) Interpret your results. (2 Marks)

b) Ivy, a community health officer, is assessing the impact of a maternal health education program. She randomly selects a sample of 26 women who participated in the program and records their post-assessment scores. The sample mean score is 68, and the population standard deviation is known to be 3. Compute the 95% confidence interval estimate for the population mean score and interpret your answer. (4 Marks)

c) A sample of 500 respondents was selected in a large metropolitan area to determine various information concerning consumer behavior. The following contingency table was obtained:

Enjoy Shopping for Clothing	MALE	FEMALE	TOTAL
YES	104	36	140
NO	136	224	360
TOTAL	240	260	500

i) What is the probability that a respondent does not enjoy shopping for clothing. (2 Marks)

ii) What is probability that the respondent chosen is a woman who enjoys shopping for Clothing. (2 Marks)

iii) Given that the respondent chosen enjoys shopping for clothing. What, then, is the probability that the individual is a male. (2 Marks)

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

t Table

cum. prob	$t_{.50}$	$t_{.75}$	$t_{.80}$	$t_{.85}$	$t_{.90}$	$t_{.95}$	$t_{.975}$	$t_{.99}$	$t_{.995}$	$t_{.999}$	$t_{.9995}$
one-tail	0.50	0.25	0.20	0.15	0.10	0.05	0.025	0.01	0.005	0.001	0.0005
two-tails	1.00	0.50	0.40	0.30	0.20	0.10	0.05	0.02	0.01	0.002	0.001
df											
1	0.000	1.000	1.376	1.963	3.078	6.314	12.71	31.82	63.66	318.31	636.62
2	0.000	0.816	1.061	1.386	1.886	2.920	4.303	6.965	9.925	22.327	31.599
3	0.000	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	10.215	12.924
4	0.000	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	0.000	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	0.000	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	0.000	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	0.000	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	0.000	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	0.000	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	0.000	0.697	0.876	1.088	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	0.000	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	0.000	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	0.000	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	0.000	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	0.000	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	0.000	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	0.000	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	0.000	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	0.000	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	0.000	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	0.000	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	0.000	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.485	3.768
24	0.000	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	0.000	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	0.000	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	0.000	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	0.000	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	0.000	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	0.000	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	0.000	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	0.000	0.679	0.848	1.045	1.296	1.671	2.000	2.390	2.660	3.232	3.460
80	0.000	0.678	0.846	1.043	1.292	1.664	1.990	2.374	2.639	3.195	3.416
100	0.000	0.677	0.845	1.042	1.290	1.660	1.984	2.364	2.626	3.174	3.390
1000	0.000	0.675	0.842	1.037	1.282	1.646	1.962	2.330	2.581	3.098	3.300
z	0.000	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.090	3.291
	0%	50%	60%	70%	80%	90%	95%	98%	99%	99.8%	99.9%
	Confidence Level										