NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: BACHELOR OF INFORMATICS BACHELOR OF COMPUTER SCIENCE	
QUALIFICATION CODE: 07BAIF 07BACS	**LEVEL:** 6
COURSE CODE: ASP612S	**COURSE NAME:** APPLIED STATISTICS & PROBABILITY FOR IT
SESSION: JUNE 2019	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
EXAMINERS:	**MR. A. ROUX**
MODERATOR:	**DR. I.K.O. AJIBOLA**

INSTRUCTIONS
1. Answer **ALL** the questions. 2. Number the answers **clearly** and show **clearly ALL** the steps used in the calculations. 3. All written work **MUST** be done in blue or black ink.

PERMISSIBLE MATERIAL

1. Non-Programmable Calculator without the cover.

ATTACHMENTS

1. Formulae sheet.
2. Statistical tables (Z and T).
3. 1 x A4 Graph Sheet

THIS QUESTION PAPER CONSISTS OF 6 PAGES (Including this front page)

QUESTION 1 [14 x 2 = 28]

Write down the letter corresponding to your choice next to the question number

1.1) Which of the following methods are used in analysing categorical (qualitative) data (2)

A. Bar charts, pie charts and Histogram

B. Bar charts, pie charts and frequency tables

C. Mean, median and mode

D.variance, standard deviation and coefficient of variation

E. None of the above

1.2) In a positively skewed distribution, the mean is (2)

A. below the median

B. above the median

C. equal to the median

D. below the mode

E. none of the above

1.3) Which of the following are measures of dispersion (spread) (2)

A. Range, Variance and Standard deviation

B. Range, mean, median and mode

C. Mean, median and mode

D. Quartile, Decile and percentile

E. Mean, median and percentile

1.4) Census are rarely done as compared to sample surveys because: (2)

A. Sample surveys can be done in a short time as compared to censuses

B. Sample surveys are cheap to implement as compared to censuses

C. Sample surveys are easy to implement as compared to censuses

D. All of the above

1.5) Fill in the blank to make the following sentence true: "The ----------of a

particular outcome is the number of times it occurs within a specific sample of a population ." (2)

A. Fequency

B. Varaince

C. Mean deviation

D. Distribution

E. Mean

1.6) A Sample of a population is: (2)

A. A subset of the population
B. An experiment in the population
C. An outcome of the population
D. A variable in the population
E. All of the above

1.7) Height is a _____measurement scale variable (2)

A. Ordinal

B. Interval

C. Ratio

D. Nominal

E. None of the above

1.8) Consider the shoes size of 12 students at NUST:

4, 6, 12, 7, 9, 7, 8, 11, 8, 8, 11, 5

Which of the following answers is incorrect?

A. This is a bimodal distribution
B. The range of this data values is 8.
C. The modal shoes size is 8.
D. The lowest value of this data values is 4.
E.The median of this data values is 8.

1.9) Which of the following statements is not true about the mean? (2)

A. The value of the mean times the number of observations equals the sum of the of all observations

B. It utilizes all values in its calculation

C. It is not affected by extreme values (outliers)

D. It is the best measure of central tendency when the data is not skewed

E. In a symmetric distribution, the mean, the median and the mode are all equal

1.10) For each of the following random variables, state the data type(i.e. Categorical or Numeric) of each random variable and the measurement scale(i.e. nominal, ordinal, interval, or ratio scaled):

(i) The ages of athletes in a marathon (2)

(ii) The marital status of employees (2)

(iii) The ranked preferences of employees to three different pay schemes (2)

(iv) The rainfall received for April 2019 (2)

(v) The distances travelled by ten tourists (2)

QUESTION 2 [37]

2.1) A variable is normally distributed with mean 6 and standard deviation 2. Find the probability that the variable will

2.1.1) lie between 1 and 7 (inclusive). (4)

2.1.2) at least 5. (4)

2.1.3) at most 4 (4)

2.2) The Ministry of Health claims that 40% of patients on physiotherapy treatment recover within 6 month. This is denied by the Medical Aid Scheme. To prove the Ministry's claim wrong, the Medical Aid Scheme commissioned a survey amongst seventy six physiotherapy patients in the Hardap Region. Out of the 76 patients 46 of them did not recover within 6 monthhs. Test the appropriate hypothesis in this matter.

2.2.1) State the hypothesis (2)

2.2.2) Formulate the decision rule using a 10% level of significance (2)

2.2.3) Select and compute the sample statistic (5)

2.2.4 What is the decision and conclusion (2)

2.3) The Office of the Registrar has revealed that only 12 out of every 20 students graduate. Based upon this assumption, determine the probability that out of a

random sample of 5 students

2.3.1) None will graduate (3)
2.3.2) All will graduate. (3)
2.3.4) At least one student will graduate (4)
2.3.3) At most one student will graduate (4)

QUESTION 3 [20]

3.1 Suppose that the following contingency table was set up:

	C	D
A	10	30
B	25	35

What is the probability of:

3.1.1 Event A (1)

3.1.2 Event A and C (1)

3.1.3 Event A and B (1)

3.1.4 Event B or D (2)

3.1.5 Event C or D (2)

3.1.6 P (A / D) (2)

3.2) A local ambulance service handles 0 to 5 service calls on any given day. The probability distribution for the number of service calls is as follows

Number of service calls (x)	Probability, p(x)
0	0.10
1	0.15
2	0.30
3	0.20
4	0.15
5	0.10

3.2.1 Find P ($1 \leq x \leq 3$) (2)

3.2.2 What is the expected number of service calls? (2)

3.2.3 What is the variance in the number of service calls? (4)

3.2.4 What is the standard deviation? (1)

3.2.5 What is the coefficient of variation in the number of service calls (2)

QUESTION 4 [15]

The table below shows the annual rainfall (x 100 mm) recorded during the last decade at the Goabeb Research Station in the Namib Desert

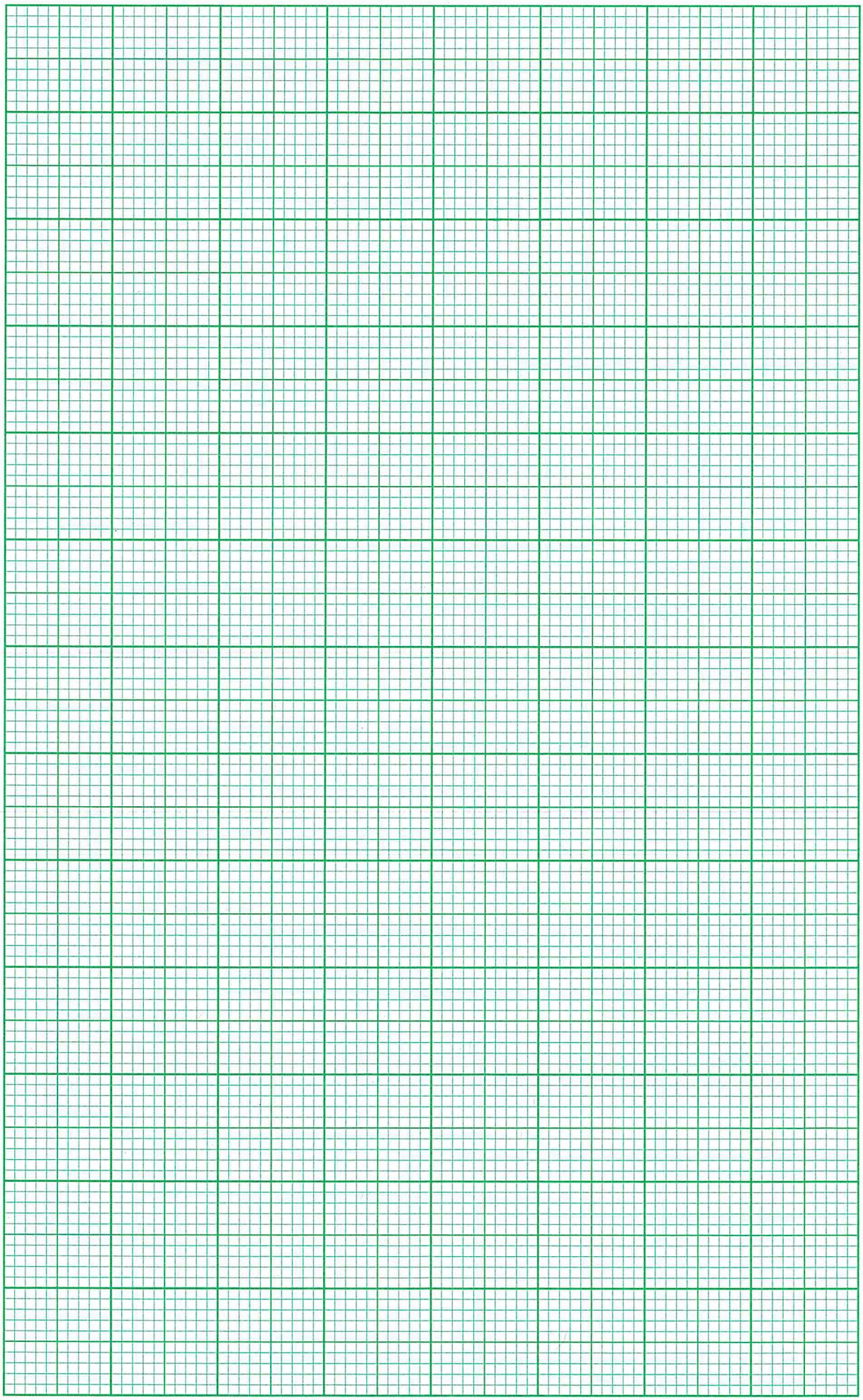
Year	Rainfall
2004	3.0
2005	4.2
2006	4.8
2007	3.7
2008	3.4
2009	4.3
2010	5.6
2011	4.4
2012	3.8
2013	4.1

4.1 Construct a scatter plot (4)

4.2 Determine the least squares trend line equation, using the sequential coding method with 2004 = 1 . (7)

4.3 Use the trend line equation obtained in 4.2 to find rainfall for 2002 and 2017 (4)

Xxxxxxxxxxxxxxxxxxxxxxxx END OF EXAMINATION xxxxxxxxxxxxxxxx



APPENDIX A

Population mean, raw data

$$\mu = \frac{\sum x}{N}$$

Sample mean, raw data

$$\bar{X} = \frac{\sum x}{n}$$

Weighted mean

$$\overline{X_w} = \frac{w_1 X_1 + w_2 X_2 + \ldots + w_n X_n}{w_1 + w_2 + \ldots + w_n}$$

Geometric mean

$$GM = \sqrt[n]{(X_1)\ (X_2)\ (X_3)\ \ldots\ (X_n)}$$

Geometric mean rate of increase

$$GM = \sqrt[n]{\frac{\text{Value at end of period}}{\text{Value at start of period}}} - 1.0$$

Sample mean grouped data

$$\overline{X} = \frac{\sum fx}{n}$$

Median of grouped data

$$\text{Median} = L + \frac{\frac{n}{2} - CF}{f}\ (\text{Class width})$$

Mean deviation

$$MD = \frac{\sum |\ X - \bar{X}\ |}{n}$$

Linear regression equation

$$Y = a + bX$$

Sample variance for raw data

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

Sample variance, raw data computational form

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

Sample standard deviation, raw data

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

Sample standard deviation, grouped data

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

Coefficient of variation

$$CV = \frac{S}{X}\ (100)$$

Location of percentile

$$L_p = (n + 1)\ \frac{P}{100}$$

Pearson's Correlation coefficient

$$r = \frac{n\ (\sum XY) - (\sum X)\ (\sum Y)}{\sqrt{[n\ (\sum X^2) - (\sum X)^2]\ [n\ (\sum Y^2) - (\sum Y)^2]}}$$

Correlation test of hypothesis

$$t = \frac{r\sqrt{n - 2}}{\sqrt{1 - r^2}}$$

Population standard deviation for raw data

$$\sigma = \sqrt{\frac{\sum (X - \mu)^2}{N}}$$

Population variance for raw data

$$\sigma^2 = \frac{\sum (X - \mu)^2}{N}$$

Slope of regression line

$$b = \frac{n\ (\sum XY) - (\sum X)\ (\sum Y)}{n\ (\sum X^2) - (\sum X)^2}$$

Intercept of a regression line

$$a = \frac{\sum Y}{n} - b\left(\frac{\sum X}{n}\right)$$

The Range

$$\text{Range} = \text{highest} - \text{lowest}$$

APPENDIX B: ADDITIONAL FORMULAE

$$\text{Mode} = L + \left(\frac{d_1}{d_1 + d_2}\right) \times c$$

$$\text{position } Q_j = \frac{jn}{4} \qquad \text{value } Q_j = L + \frac{\left(\frac{jn}{4} - F\right) \times c}{f_{Q_j}}$$

$$\text{position } P_j = \frac{jn}{100} \qquad \text{value } P_j = L + \frac{\left(\frac{jn}{100} - F\right) \times c}{f_{P_j}}$$

$$P(A|B) = \frac{P(A \cap B)}{P(B)} \qquad P(x) = \frac{n!}{x!(n-x)!}\pi^x(1-\pi)^{n-x} \qquad \text{P (x)} = \frac{\lambda^x e^{-\lambda}}{x!}$$

$$z = \frac{x - \mu}{\sigma} \qquad z_{calc} = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} \qquad t_{calc} = \frac{\bar{x} - \mu}{s/\sqrt{n}}$$

$$z_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \qquad t_{calc} = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{(n-1)s_1^2 + (n-1)s_2^2}{n_1 + n_2 - 1}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

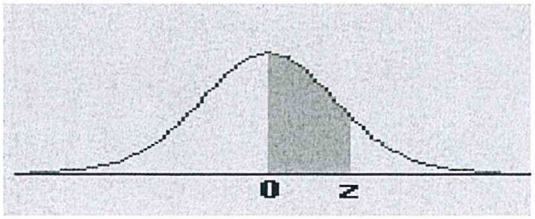
$$z = \frac{p - \pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} \qquad z_{calc} = \frac{p_A - p_B}{\sqrt{(p \times q)\left(\frac{1}{n_A} + \frac{1}{n_B}\right)}} \qquad p = \frac{n_A p_B + n_B p_A}{n_A + n_B} \qquad q = 1 - p$$

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

$$F_V = P_V(1 + in) \qquad F_V = P_V(1+i)^n \qquad r = (1+i)^m - 1 \qquad D = B(1-i)^n$$

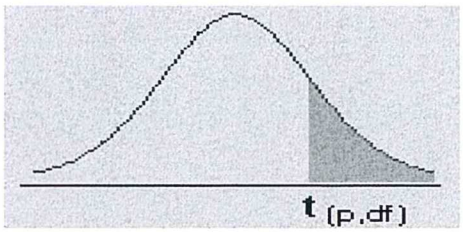
$$P = \frac{A}{(1+i)^n} \qquad PV = \frac{P(1+i)^n}{(1+j)^n} \qquad IRR = \frac{N_1 I_2 - N_2 I_1}{N_1 - N_2}$$

APPENDIX A: The Standard Normal Distribution



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

APPENDIX B: The t-distribution



df\p	0.40	0.25	0.10	0.05	0.025	0.01	0.005	0.0005
1	0.324920	1.000000	3.077684	6.313752	12.70620	31.82052	63.65674	636.6192
2	0.288675	0.816497	1.885618	2.919986	4.30265	6.96456	9.92484	31.5991
3	0.276671	0.764892	1.637744	2.353363	3.18245	4.54070	5.84091	12.9240
4	0.270722	0.740697	1.533206	2.131847	2.77645	3.74695	4.60409	8.6103
5	0.267181	0.726687	1.475884	2.015048	2.57058	3.36493	4.03214	6.8688
6	0.264835	0.717558	1.439756	1.943180	2.44691	3.14267	3.70743	5.9588
7	0.263167	0.711142	1.414924	1.894579	2.36462	2.99795	3.49948	5.4079
8	0.261921	0.706387	1.396815	1.859548	2.30600	2.89646	3.35539	5.0413
9	0.260955	0.702722	1.383029	1.833113	2.26216	2.82144	3.24984	4.7809
10	0.260185	0.699812	1.372184	1.812461	2.22814	2.76377	3.16927	4.5869
11	0.259556	0.697445	1.363430	1.795885	2.20099	2.71808	3.10581	4.4370
12	0.259033	0.695483	1.356217	1.782288	2.17881	2.68100	3.05454	4.3178
13	0.258591	0.693829	1.350171	1.770933	2.16037	2.65031	3.01228	4.2208
14	0.258213	0.692417	1.345030	1.761310	2.14479	2.62449	2.97684	4.1405
15	0.257885	0.691197	1.340606	1.753050	2.13145	2.60248	2.94671	4.0728
16	0.257599	0.690132	1.336757	1.745884	2.11991	2.58349	2.92078	4.0150
17	0.257347	0.689195	1.333379	1.739607	2.10982	2.56693	2.89823	3.9651
18	0.257123	0.688364	1.330391	1.734064	2.10092	2.55238	2.87844	3.9216
19	0.256923	0.687621	1.327728	1.729133	2.09302	2.53948	2.86093	3.8834
20	0.256743	0.686954	1.325341	1.724718	2.08596	2.52798	2.84534	3.8495
21	0.256580	0.686352	1.323188	1.720743	2.07961	2.51765	2.83136	3.8193
22	0.256432	0.685805	1.321237	1.717144	2.07387	2.50832	2.81876	3.7921
23	0.256297	0.685306	1.319460	1.713872	2.06866	2.49987	2.80734	3.7676
24	0.256173	0.684850	1.317836	1.710882	2.06390	2.49216	2.79694	3.7454
25	0.256060	0.684430	1.316345	1.708141	2.05954	2.48511	2.78744	3.7251
26	0.255955	0.684043	1.314972	1.705618	2.05553	2.47863	2.77871	3.7066
27	0.255858	0.683685	1.313703	1.703288	2.05183	2.47266	2.77068	3.6896
28	0.255768	0.683353	1.312527	1.701131	2.04841	2.46714	2.76326	3.6739
29	0.255684	0.683044	1.311434	1.699127	2.04523	2.46202	2.75639	3.6594
30	0.255605	0.682756	1.310415	1.697261	2.04227	2.45726	2.75000	3.6460
inf	0.253347	0.674490	1.281552	1.644854	1.95996	2.32635	2.57583	3.2905