



BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous Institute, Affiliated to VTU

**DEPARTMENT OF COMPUTER SCIENCE AND
BUSINESS SYSTEMS**

**Statistical Data Analysis Report submitted for the partial
fulfilment of the Alternative Assessment Test (AAT) for the
course Statistical Modeling for Business Systems
(24MA4BSSBS)**

Team Number:01

Participant Details

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Sampreet N	1BM24CB042
Tushar Jain	1BM24CB056

Certificate of successful submission of report

*This is to certify that the following students have satisfactorily completed the hands-on data analysis report on the topic “**Does Mobile Detox Improve Sleep Quality?**” as a part of the 4th Semester course Statistical Modeling for Business Systems (24MA4BSSBS) for the academic year 2025-2026:*

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Faculty-in-Charge:

Dr. Rajashi Chatterjee, Assistant Professor, Department of Mathematics, B.M.S.C.E

Signature:

Problem Statement

Does Mobile Detox Improve Sleep Quality?

OBJECTIVES OF THE STUDY

1. To study the relationship between mobile detox and sleep quality.
2. To construct a standardized Sleep Quality Index (SQI).
3. To compare the average sleep quality scores between the detox group and the non-detox group.
4. To determine whether the observed difference in sleep quality is statistically significant.

SCOPE AND LIMITATIONS

The scope of this study is restricted to primary survey data collected from a controlled sample size of 22 respondents. The data primarily covers the 18-22 and 45-50 age groups. *Limitations:* Because the sample size is limited to 22, the results may not perfectly represent the global population. However, the responses were carefully screened and cleaned before analysis to ensure maximum internal validity within the sample.

Methodology

The research utilized primary data collection through a structured questionnaire floated via Google Forms.

1. **Questionnaire Design:** The survey was designed to capture vital metrics including caffeine intake, stress, screen time, sleep duration, and morning refreshment.
2. **Response Collection:** Links were distributed, and 22 valid responses were collected. (Both English and Hindi forms were generated to accommodate respondents, but all parameters analyzed were identical).
3. **Data Cleaning:** Raw responses were manually evaluated.
4. **Conversion:** Qualitative answers were systematically converted into numerical scores based on predefined weightages.
5. **Statistical Analysis:** Manual calculation of descriptive statistics and an independent two-sample t-test was performed to test the hypotheses.

Source data

Timestamp	name	1. Do you consent to participate in this study?	2. What is your current age?	3. On a typical day, how many cups of coffee?	4. On a scale of 1 to 10, how overwhelmed are you?	5. Do you actively practice a "mobile detox"?	6. How long before attempting to sleep do you stop using your phone?
6-1-2026 16:48:22	Ayush	Yes	20	0	7	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-1-2026 18:37:17	Yash	Yes	20	2	5	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-1-2026 18:37:47	Srujan S	Yes	19	0	3	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-1-2026 18:43:49	Anubhav	Yes	20	0	6	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-4-2026 10:58:28	Sampreet N	Yes	19	0	1	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-6-2026 22:43:43	Amish	Yes	24	2	8	No, I use my phone normally until I go to sleep	30 to 60 minutes
6-6-2026 22:45:42	Mayank	Yes	20	0	7	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 20:40:58	Aryan singh	Yes	20	0	1	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 21:06:35	Akash CL	Yes	21	0	7	Yes, I intentionally restrict phone use before	30 to 60 minutes
6-9-2026 21:03:04	Niranjan	Yes	19	1	6	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 21:39:58	AARYAN	Yes	23	0	5	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 21:48:26	Nandini	Yes	19	0	9	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 21:50:03	Purab Jain	Yes	20	0	6	Yes, I intentionally restrict phone use before	Less than 30 minutes
6-9-2026 21:50:15	Anshika	Yes	19	0	6	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 21:53:25	Suprabh P Khandke	Yes	21	1	4	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 23:20:41	Samarth Talwar	Yes	20	0	4	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 23:20:50	Avinash	Yes	19	1	5	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 23:21:30	Sudharma Kulkarni	Yes	19	1	6	No, I use my phone normally until I go to sleep	Less than 30 minutes
6-9-2026 23:23:09	Ravi Suresh Pated	Yes	20	1	4	Yes, I intentionally restrict phone use before	Less than 30 minutes
6-9-2026 23:27:28	Somu	Yes	19	0	4	No, I use my phone normally until I go to sleep	Less than 30 minutes

7. How many days per week do you succeed?	8. Over the past week, how many hours of sleep did you get?	9. Approximately how long does it usually take you to fall asleep?	10. On a scale of 1 to 10, how would you rate your stress?	11. On a scale of 1 to 10, how refreshed do you feel in the morning?
1 6 to 7 hours	30 to 60 minutes		7	7
1 7 to 8 hours	15 to 30 minutes		10	7
4 6 to 7 hours	Under 15 minutes		10	8
7 Less than 5 hours	Under 15 minutes		4	5
1 5 to 6 hours	Under 15 minutes		4	6
2 Less than 5 hours	30 to 60 minutes		2	2
2 6 to 7 hours	30 to 60 minutes		10	3
1 Less than 5 hours	30 to 60 minutes		6	10
7 6 to 7 hours	Under 15 minutes		8	8
1 7 to 8 hours	15 to 30 minutes		8	4
2 More than 8 hours	15 to 30 minutes		8	5
2 6 to 7 hours	15 to 30 minutes		3	1
4 6 to 7 hours	Under 15 minutes		7	8
1 More than 8 hours	15 to 30 minutes		4	3
1 6 to 7 hours	15 to 30 minutes		10	10
1 6 to 7 hours	Over 1 hour		4	5
4 5 to 6 hours	Under 15 minutes		7	3
1 5 to 6 hours	30 to 60 minutes		8	5
1 6 to 7 hours	15 to 30 minutes		5	2
1 7 to 8 hours	15 to 30 minutes		9	9

Google Form Survey Link:

<https://docs.google.com/forms/d/e/1FAIpQLScMXxy5E4qOvISpX-Uo6qeNdC0IgAf097vvivSk8MJsNW2BNA/viewform?usp=sharing&oid=117946839377520536833>

Cleaned data

Before analysis, the raw dataset underwent rigorous cleaning. Irrelevant, incomplete, and unacceptable responses were removed from the initial pool. Only the 22 completely valid responses were retained. Rather than analyzing raw categorical text, the data was prioritized and converted strictly into numerical values using predetermined scoring weights.

S.No.	Participant Name	Mobile Detox	Stress Present	Caffeine Consumption	Sleep Hours	Sleep Latency	Sleep Quality Score	Refreshed Score
1	Ayush	No	Yes	0	6 to 7 hours	30 to 60 minutes	7	7
2	Yash	No	Yes	2	7 to 8 hours	15 to 30 minutes	10	7
3	Srujan S	No	No	0	6 to 7 hours	Under 15 minutes	10	8
4	Anubhav	No	Yes	0	Less than 5 hours	Under 15 minutes	4	5
5	Sampreet N	No	No	0	5 to 6 hours	Under 15 minutes	4	6
6	Amish	No	Yes	2	Less than 5 hours	30 to 60 minutes	2	2
7	Mayank	No	Yes	0	6 to 7 hours	30 to 60 minutes	10	3
8	Aryan Singh	No	No	0	Less than 5 hours	30 to 60 minutes	6	10
9	Akash CL	Yes	Yes	0	6 to 7 hours	Under 15 minutes	8	8
10	Niranjana	No	Yes	1	7 to 8 hours	15 to 30 minutes	8	4
11	Aaryan	No	Yes	0	More than 8 hours	15 to 30 minutes	8	5
12	Nandini	No	Yes	0	6 to 7 hours	15 to 30 minutes	3	1
13	Purab Jain	Yes	Yes	0	6 to 7 hours	Under 15 minutes	7	8
14	Anshika	No	Yes	0	More than 8 hours	15 to 30 minutes	4	3
15	Suprabh P Khandke	No	No	1	6 to 7 hours	15 to 30 minutes	10	10
16	Samarth Talwar	No	No	0	6 to 7 hours	Over 1 hour	4	5
17	Avinash	No	Yes	1	5 to 6 hours	Under 15 minutes	7	3
18	Sudharma Kulkarni	No	Yes	1	5 to 6 hours	30 to 60 minutes	8	5
19	Ravi Suresh Pated	Yes	No	1	6 to 7 hours	15 to 30 minutes	5	2
20	Sonu	No	No	0	7 to 8 hours	15 to 30 minutes	9	9
21	Renu Kumari Jain	Yes	No	0	6 to 7 hours	30 to 60 minutes	7	8
22	Anupama Jain	Yes	No	1	6 to 7 hours	Under 15 minutes	10	10

CONSTRUCTION OF SLEEP QUALITY INDEX (SQI)

To quantify sleep quality, a comprehensive index was created. The formula used for calculation is strictly defined as follows:

$$SQI = 0.10C + 0.15S + 0.05M + 0.10P + 0.10D + 0.20H + 0.15L + 0.15R$$

Where:

- C = Caffeine score
- S = Stress score (reverse coded)
- M = Mobile detox score
- P = Phone-free time score
- D = Detox consistency score
- H = Sleep duration score
- L = Sleep latency score
- R = Morning refreshment score

Table 2: Scoring Systems for SQI Variables

1) Caffeine Score (C)

<i>Cups</i>	<i>Score</i>
<i>0</i>	<i>10</i>
<i>1</i>	<i>7.5</i>
<i>2</i>	<i>5</i>
<i>3</i>	<i>2.5</i>
<i>4+</i>	<i>0</i>

2) Stress Score (S) (Reverse)

S = 11 - original score (where original score runs from 1 to 10)

3) Mobile Detox Score (M)

Yes = 10, No = 0

4) Phone-Free Time Score (P)

<i>Time</i>	<i>Score</i>
<i>Less than 30 min</i>	<i>0</i>
<i>30 - 60 min</i>	<i>4</i>
<i>1 - 2 hrs</i>	<i>7</i>
<i>More than 2 hrs</i>	<i>10</i>

5) Detox Consistency Score (D)

$D = 10d / 7$ (where d = number of detox days from 0 to 7)

6) Sleep Duration Score (H)

<i>Sleep Hours</i>	<i>Score</i>
<i>< 5</i>	<i>0</i>
<i>5 - 6</i>	<i>4</i>
<i>6 - 7</i>	<i>7</i>
<i>7 - 8</i>	<i>10</i>
<i>> 8</i>	<i>9</i>

Here is a breakdown of how the scoring works based on the data provided:

- **Optimal Sleep:** The highest score of **10** is awarded for getting between **7 and 8 hours** of sleep, indicating this is considered the ideal duration.
- **Slight Oversleeping:** Sleeping **more than 8 hours** results in a minor penalty, dropping the score slightly to **9**.

- **Mild Sleep Deprivation:** Getting between **6 and 7 hours** of sleep lowers the score to 7.
- **Moderate Sleep Deprivation:** Sleeping between **5 and 6 hours** significantly reduces the score to 4.
- **Severe Sleep Deprivation:** Getting **less than 5 hours** of sleep yields a score of 0, indicating the poorest outcome in this metric.

7) Sleep Latency Score (L)

<i>Time to Sleep</i>	<i>Score</i>
<i>Under 15 min</i>	<i>10</i>
<i>15–30 min</i>	<i>8</i>
<i>30–60 min</i>	<i>4</i>
<i>Over 1 hr</i>	<i>0</i>

8) Morning Refreshment Score (R)

Score exactly mirrors the 1-10 categorical response given by the user in the survey form.

CLASSIFICATION OF SQI

Table 3: Classification Rubric

SQI Score Range	Classification
9 - 10	Excellent
8 - 8.99	Very Good
7 - 7.99	Good
6 - 6.99	Fair
5 - 5.99	Poor
Below 5	Very Poor

DESCRIPTIVE ANALYSIS

Applying the formula to the cleaned data yielded the following final scores:

Table 4: Respondent wise Analyzed SQI

Detox Group (n=5)

S. No.	Name	Detox	SQI
1	Aakash CL	Yes	7.60
2	Purab Jain	Yes	6.92
3	Renu	Yes	7.45
4	Anupama	Yes	7.96
5	Ravi Suresh	Yes	4.68

Non-Detox Group (n=17)

S. No.	Name	Detox	SQI
6	Ayush	No	4.79
7	Yash	No	6.29
8	Surjan	No	6.86
9	Anubhav	No	4.54
10	Sampreet	No	5.46
11	Anush	No	2.86
12	Mayank	No	4.94
13	Aryan Sengh	No	5.89
14	Niranjan	No	5.44
15	Aaryan	No	6.19
16	Nandini	No	3.39
17	Anshikaa	No	4.74
18	Suyash	No	7.29
19	Samarth	No	4.11
20	Arinash	No	5.19
21	Sudharma	No	7.59
22	Somu	No	7.24

Table 5: Descriptive Statistics

Metric	Detox Group	Non-Detox Group
Sample Size (n)	n1 = 5	n2 = 17
Mean SQI ($\bar{x}$)	6.9214	5.1097
Standard Deviation (s)	0.9303	1.0870

- Difference in Means = 1.8118
- Pooled Variance = 1.1184
- Pooled Standard Deviation = 1.0575
- t-statistic = 3.18
- Degrees of Freedom (df) = 20

ANALYSIS OF DATA

The survey responses were cleaned and analyzed to study the relationship between mobile detox practices and sleep quality. Graphical representations here are used to summarize data and identify trends within the sample. The results obtained from the analysis are presented below.

STATISTICAL ANALYSIS & GRAPHS

Figure 1: Proportion of Sample Practicing Mobile Detox

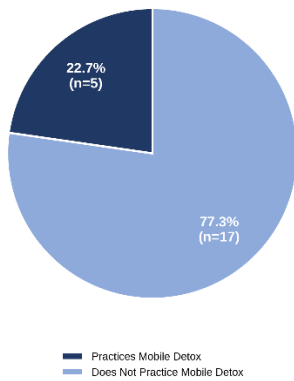


Figure 2: Age Distribution of the Survey Sample

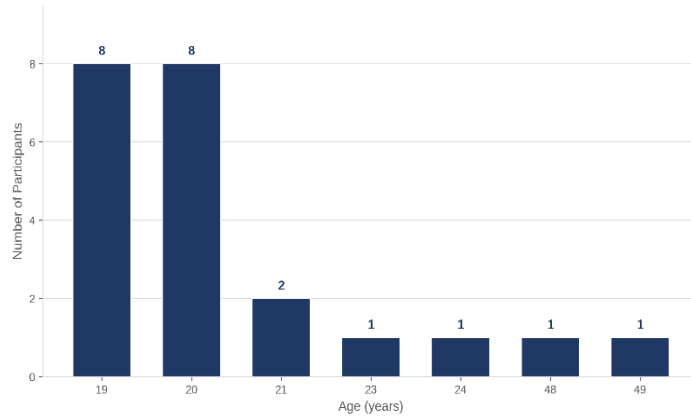
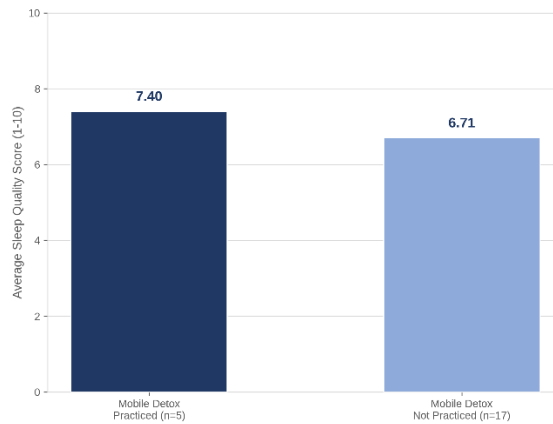


Figure 3: Average Sleep Quality Index (SQI) by Mobile Detox Group



Identification

The **Independent Two-Sample t-test** was chosen for this study because:

- There are two distinct, independent groups (Detox vs. Non-Detox).
- The sample size is small ($n < 30$).
- The objective is to compare the means of these two groups.
- The population variance is unknown.
- The qualitative responses were effectively converted into a quantitative, continuous score (SQI).

Formulate the hypotheses

A Right-Tailed Test is utilized.

- **Null Hypothesis (H0):** $\mu_1 - \mu_2 = 0$. There is no significant difference in the mean Sleep Quality Index (SQI) scores between individuals who practice mobile detox and those who do not practice mobile detox.
- **Alternative Hypothesis (H1):** $\mu_1 - \mu_2 > 0$. Individuals who practice mobile detox have a significantly higher mean Sleep Quality Index (SQI) score than individuals who do not practice mobile detox.

Selection of an appropriate test

Test Used: Difference of means using the independent two-sample t-test.

Conduction of hypothesis test

Step-by-Step Manual Calculation:

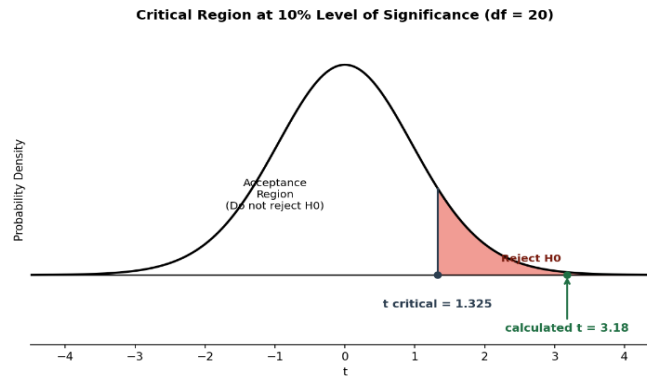
- **Sample Sizes:** $n_1 = 5, n_2 = 17$
- **Means:** $\bar{x}_1 = 6.9214, \bar{x}_2 = 5.1097$
- **Standard Deviations:** $s_1 = 0.9303, s_2 = 1.0870$
- **Pooled Variance (S2):** 1.1184
- **Pooled Standard Deviation (S):** 1.0575
- **Degrees of Freedom (df):** $n_1 + n_2 - 2 = 5 + 17 - 2 = 20$
- **Calculated t-statistics:** 3.18

Decision and Conclusion

For $df = 20$ (Right Tailed):

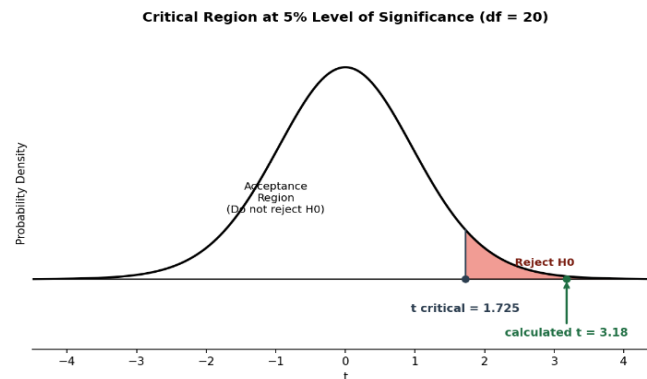
1. At 10% Level of Significance (LOS):

- Critical Value (t): 1.325
- **Decision:** Since calculated t (3.18) > 1.325, we Reject H_0 .



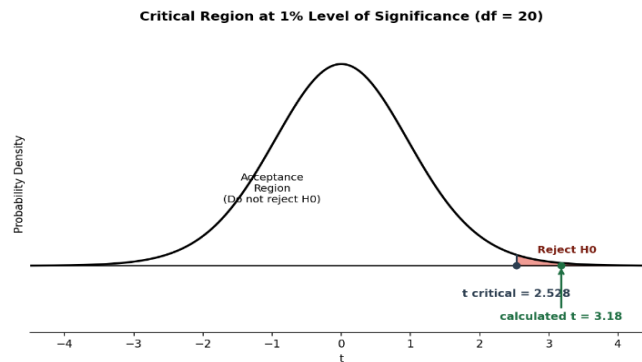
2. At 5% Level of Significance (LOS):

- Critical Value (t): 1.725
- **Decision:** Since calculated t (3.18) > 1.725, we Reject H_0 .



3. At 1% Level of Significance (LOS):

- Critical Value (t): 2.528
- **Decision:** Since calculated t (3.18) > 2.528, we Reject H₀.



- **Conclusion:** It is evident that Individuals who practice mobile detox have a significantly higher mean Sleep Quality Index (SQI) score than individuals who do not practice mobile detox under 10%, 5%, 1% L.O.S.

Individual author contributions

Student Name	Contribution
Ayush Kumar (1BM24CB016)	Designed the survey questionnaire, collected responses, and coordinated data gathering.
Niranjan K (1BM24CB035)	Assisted in data cleaning, validation of responses, and preparation of the cleaned dataset, Performed statistical calculations, data visualizations.
Rishabh Gupta(1BM24CB039)	Conducted literature review, formatted the report, descriptive analysis, and hypothesis testing, collecting data.
Sampreet N (1BM24CB042)	Constructed the Sleep Quality Index (SQI), prepared graphs/visualizations, and drafted the report findings and conclusions.
Tushar Jain (1BM24CB056)	Compiled references, Formatted the report, data analysis reviewed the final document before submission, Performed statistical calculations.

Acknowledgement and References

Cite all references used for data sources, methods, and theoretical background (in APA style). Acknowledge, in brief, the assistance of any person or organization you have received for the completion of this report.

Student's Name	USN	Signatures
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References

1. Montgomery, D. C., & Runger, G. C. (2018). *Applied Statistics and Probability for Engineers* (7th ed.). Wiley.
2. Google Forms Survey Responses (2026).
3. World Health Organization. *Sleep and Health*. <https://www.who.int>

Assessment details

Student Name	USN	Presentation and viva	Report	Total (10)
Ayush Kumar	1BM24CB016			
Niranjan K	1BM24CB035			
Rishabh Gupta	1BM24CB039			
Sampreet N	1BM24CB042			
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Report Submission Certificate

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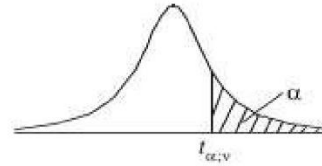
Faculty-in-Charge:

Dr. Rajashi Chatterjee, Assistant Professor, Department of Mathematics, B.M.S.C.E

Signature:

Table of the Student's t -distribution

The table gives the values of $t_{\alpha, v}$ where
 $\Pr(T_v > t_{\alpha, v}) = \alpha$, with v degrees of freedom



$\alpha \backslash v$	0.1	0.05	0.025	0.01	0.005	0.001	0.0005
1	3.078	6.314	12.076	31.821	63.657	318.310	636.620
2	1.886	2.920	4.303	6.965	9.925	22.326	31.598
3	1.638	2.353	3.182	4.541	5.841	10.213	12.924
4	1.533	2.132	2.776	3.747	4.604	7.173	8.610
5	1.476	2.015	2.571	3.365	4.032	5.893	6.869
6	1.440	1.943	2.447	3.143	3.707	5.208	5.959
7	1.415	1.895	2.365	2.998	3.499	4.785	5.408
8	1.397	1.860	2.306	2.896	3.355	4.501	5.041
9	1.383	1.833	2.262	2.821	3.250	4.297	4.781
10	1.372	1.812	2.228	2.764	3.169	4.144	4.587
11	1.363	1.796	2.201	2.718	3.106	4.025	4.437
12	1.356	1.782	2.179	2.681	3.055	3.930	4.318
13	1.350	1.771	2.160	2.650	3.012	3.852	4.221
14	1.345	1.761	2.145	2.624	2.977	3.787	4.140
15	1.341	1.753	2.131	2.602	2.947	3.733	4.073
16	1.337	1.746	2.120	2.583	2.921	3.686	4.015
17	1.333	1.740	2.110	2.567	2.898	3.646	3.965
18	1.330	1.734	2.101	2.552	2.878	3.610	3.922
19	1.328	1.729	2.093	2.539	2.861	3.579	3.883
20	1.325	1.725	2.086	2.528	2.845	3.552	3.850
21	1.323	1.721	2.080	2.518	2.831	3.527	3.819
22	1.321	1.717	2.074	2.508	2.819	3.505	3.792
23	1.319	1.714	2.069	2.500	2.807	3.485	3.767
24	1.318	1.711	2.064	2.492	2.797	3.467	3.745
25	1.316	1.708	2.060	2.485	2.787	3.450	3.725
26	1.315	1.706	2.056	2.479	2.779	3.435	3.707
27	1.314	1.703	2.052	2.473	2.771	3.421	3.690
28	1.313	1.701	2.048	2.467	2.763	3.408	3.674
29	1.311	1.699	2.045	2.462	2.756	3.396	3.659
30	1.310	1.697	2.042	2.457	2.750	3.385	3.646
40	1.303	1.684	2.021	2.423	2.704	3.307	3.551
60	1.296	1.671	2.000	2.390	2.660	3.232	3.460
120	1.289	1.658	1.980	2.358	2.617	3.160	3.373
∞	1.282	1.645	1.960	2.326	2.576	3.090	3.291