S.Y. B.Sc (D.S.) NEP – Semester IV
Internet of Things
(Time: 1 hour) **Total Marks: 30**

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat, labeled diagrams** wherever **necessary**.

1. Attempt *any three* of the following: **15**

a. What is the meaning of IoT? Define with a suitable diagram.
b. Define all characteristics of IoT.
c. What is the sensor? explain its working?
d. Discuss the IoT Application Domain.
e. Write a short note on a popular IoT development board.
f. Explain the Major components of IoT.

2. Attempt *any three* of the following: **15**

a. Write a short note on Data Acquisition and Storage in IoT.
b. Explain Zigbee with a suitable diagram.
c. Define the meaning of REST with a suitable theory.
d. Discuss the IPv6 protocol in IoT.
e. Write a short note on RFID.
f. Explain the importance of NFC.

S.Y.B.Sc.(DS) Semester IV

Shashkiya Marathi II

(Time: 1 hour) **Total Marks: 30**

Instructions for the candidate:

1. Q.1 is Compulsory.
2. Attempt any 2 from Q. 2 to Q.4.
3. Answers to each new question should begin on a fresh page.
4. Figures on the right-hand side indicate full marks.

खालील प्रश्नांची उत्तरे लिहा.

प्र-१ मराठी संकेतस्थळांचे शैक्षणिक सामाजिक आणि सांस्कृतिक योगदान स्पष्ट करा. १० गुण

प्र-२ **खालील प्रश्नांची उत्तरे लिहा.**

अ ई-मेल वापरण्याचे फायदे स्पष्ट करा ५ गुण

ब संगणकिय अनुवाद साधनांविषयी माहिती लिहा. ५ गुण

प्र-३ **खालील प्रश्नांची उत्तरे लिहा.**

अ शासकीय पत्रव्यवहार करतानाचे पाळावयाचे शिष्टाचार स्पष्ट करा. ५ गुण

ब डिजिटल दस्तऐवज लेखनाचे फायदे स्पष्ट करा. ५ गुण

प्र-४ **खालील प्रश्नांची उत्तरे लिहा.**

अ बैठकीची भाषा बोलताना तुम्ही कोणती काळजी घ्याल ? ५ गुण

ब ई गव्हर्नन्स म्हणजे काय सांगून त्याचे उद्देश स्पष्ट करा. ५ गुण

S.Y. B.Sc (D.S.) NEP – Semester IV
Internet of Things
(Time: 1 hour) **Total Marks: 30**

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(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
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1. Attempt *any three* of the following: **15**

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f. Explain the importance of NFC.

S.Y.B.Sc.(D.S.) – Semester IV
SOFTWARE ENGINEERING 12/03/2026
(Time: 30 minutes)

Total Marks: 15

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.

1. Attempt *any three* of the following: **15**

a. Define Software Engineering and examine the major challenges faced in software engineering.
b. Describe the Prototyping Model and highlight its benefits.
c. Define Requirements Engineering and describe its phases.
d. What is Module Coupling and describe its types.
e. Explain the different levels of testing.
f. Explain the principles and practices of Extreme Programming (XP).

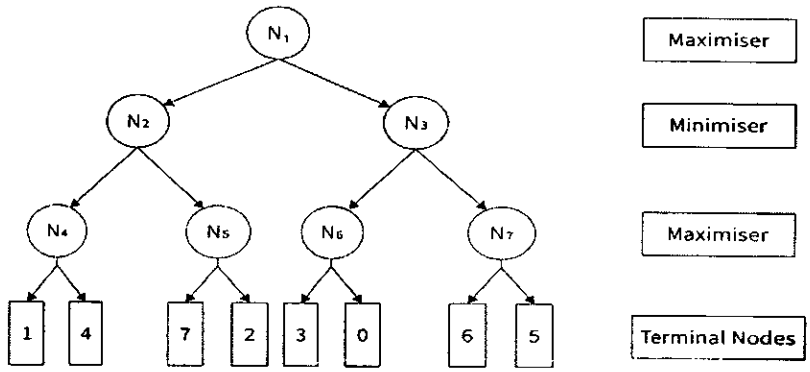
S.Y.B.Sc.(D.S.) – Semester IV
ARTIFICIAL INTELLIGENCE

13/03/26

3. Attempt *any three* of the following: 15

a. Explain min-max algorithm with suitable example.

b. Define Alpha Beta Pruning. Evaluate the below game tree by using alpha-beta pruning and find the value of node A and cutoff values for alpha and beta node.



c. Describe the roles and significance of each of the five connectives in Propositional Logic.

d. Define Wumpus world problem in terms of first order logic.

e. Derive Bayes' Theorem from Conditional Probability and explain each term in detail.

f. A dataset contains 100 emails, 40 of which are spam and 60 are not spam. An email contains the word "offer." In spam emails, 20 contain "offer," and in non-spam emails, 5 contain "offer." Using the Bayesian method, calculate the probability that an email containing "offer" is spam.

4. Attempt *any three* of the following: 15

a. Write short note on Universal and Existential quantifier with suitable example.

b. Convert the below given facts into FOL.
i) Ravi likes all kind of food
ii) Apple & chicken are food
iii) Anything anyone eats and is not killed is food
iv) Ajay eats Peanuts & still alive.

c. Differentiate between forward and backward chaining.

d. What is Resolution? Mention the steps for resolution and also for converting FOL into CNF.

e. Define Artificial Neural Network. Explain the architecture of it.

f. Discuss various types of Generative AI.

S.Y.B.Sc.(D.S.) – Semester IV
ARTIFICIAL INTELLIGENCE
(Time: 2 hours)

Total Marks: 60

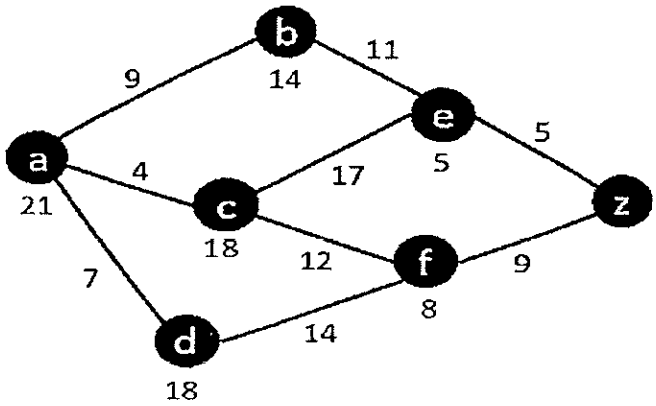
N. B.: (1) **All** questions are **compulsory**.
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(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. Attempt *any three* of the following: **15**

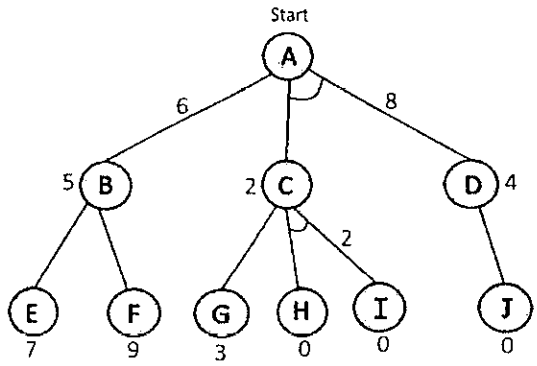
a. What is Artificial intelligence? Explain with example.
b. Describe any five state-of-the-art of AI today.
c. Explain following task environments:
i) Single Agent vs. Multiagent
ii) Episodic vs. Sequential
d. Describe the PEAS description for an automated taxi.
e. Explain the working of Goal based agent with diagram.
f. Discuss the role of knowledge representation in AI.

2. Attempt *any three* of the following: **15**

a. Explain depth first search algorithm with suitable example.
b. Differentiate between informed search and uninformed search with suitable example.
c. In the graph shown, edge values represent path costs and node values represent heuristic estimates. Apply the A* algorithm to determine the optimal path from A (start) to G (goal).



d. With the Local Search algorithm, explain the following concepts:
i) Shoulder ii) Global Maximum iii) Local Maximum
e. Explain the working mechanism of genetic algorithm.
f. Evaluate the given AND–OR graph and determine the optimal solution graph starting from node A.



S.Y.B.Sc.(D.S.) – Semester IV

Big Data

(Time: 2 hours) 14/03/2026

Total Marks: 60

N. B.: (1) **All** questions are **compulsory**.
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(3) Answers to the **same question** must be **written together**.
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(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculators is **allowed**.

1. Attempt *any three* of the following: **15**

a. Explain Emerging Big Data Ecosystem.
b. Differentiate between BI and Data Science.
c. Define Big Data. Explain the 3 V's with examples.
d. Explain the phases of Big Data Analytics Life Cycle.
e. Differentiate between Pair Plot and Heatmap. Mention their analytical use.
f. What is Data Preparation? Explain any five items from Data Cleaning Checklist.

2. Attempt *any three* of the following: **15**

a. Explain Descriptive and Diagnostic Analytics with example.
b. Differentiate between Traditional and Big Data Modelling.
c. Explain Clustering and Association Rule Mining with suitable example.
d. Write a Python program to perform **Simple Linear Regression using sklearn** for the following dataset:
Hours = [1,2,3,4,5]
Marks = [35,40,50,55,65]
Predict marks for 6 hours.
e. Explain Conceptual and Logical design views.
f. Compare Supervised and Unsupervised Learning.

3. Attempt *any three* of the following: **15**

a. What is Hadoop? Explain its core components in the Hadoop Ecosystem.
b. Explain the architecture of HDFS with NameNode, Secondary NameNode and DataNode.
c. What is Distributed Computing? Explain its advantages.
d. Explain MapReduce architecture and execution flow.
e. Explain HDFS block concept and replication mechanism.
f. Explain YARN architecture and its components.

4. Attempt *any three* of the following: **15**

a. What is Unstructured Data? Explain the need for Text Mining in Big Data Analytics.
b. What is Social Network Analysis (SNA)? Explain basic network representation (Nodes and Edges).
c. Explain the Text Preprocessing pipeline.
d. Differentiate between Bag of Words (BoW) and TF-IDF.
e. Explain the relationship between Text Mining and Natural Language Processing (NLP).
f. Explain the phases of the Analytics Lifecycle.

S. Y. B. Sc. (D.S.) – Semester IV
SUBJECT: Optimization Techniques
(Time: 2 hours)

16/03/2026

Total Marks: 60

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
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(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **non-programmable** calculators is **allowed**.

1. Attempt *any three* of the following: 15

a. Investigate extreme values of $y = 3x^3 + 18x^2 - 45x + 50$ & hence find maximum, minimum value of the function.

b. The following data represent strategies adopted by player A & Player B.

	Player B (Pay-off in '000 Rs.)			
Player A	**B1**	**B2**	**B3**	**B4**
A1	10	15	20	10
A2	20	18	25	40
A3	12	18	30	22
A4	7	14	16	9

i) Find optimal strategy of player A
ii) Find optimal strategy of player B
iii) What is the value of the game?

c. Reduce the following game to 2× 2 using dominance property & hence apply algebraic method to find optimal strategies of each player & value of the game if game has no saddle point

Player A	**Player B (Pay-off in '000 Rs.)**		
	B1	**B2**	**B3**
A1	1	7	2
A2	6	2	7
A3	5	1	6

d. Use graphical method to solve following game & hence, find value of the game

	Player B(Pay-off in '00 Rs.)			
Player A	**B1**	**B2**	**B3**	**B4**
A1	2	2	3	−2
A2	4	3	2	6

e. Define: Concave Function & Convex Function
Find the interval in which function $y = x^3 - 6x^2 - 15x + 10$ is convex & concave.

f. Write a short note on: Different types of games

2. Attempt *any three* of the following: 15

a. Write a short note on: Redundancy of constraint. Support your answer with suitable example.

b. Three types of food packets say F1, F2 & F3 are available. Each packet consists of two types of vitamins V1 & V2. One packet of F1 contains 20 mg of V1 & 15 mg of V2. One packet of F2 contains 10 mg of V1 & 12 mg of V2. One packet of F3 contains 15 mg of V1 & 20 mg of V2. Minimum daily requirement of V1 & V2 is 100 mg & 120 mg respectively. Cost of these food packets ae Rs.18, Rs.10 & Rs.15 respectively.
Formulate the above problem as LPP

c. Explain the terms: Slack variable, Surplus variable, Artificial variable

d. Solve following LPP by Simplex Method
$Max\ Z = 2x + 5y$ subject to $2x + y \leq 20, 3x + 4y \leq 24, x, y \geq 0$

e. Express the following LPP into standard form
$Min\ Z = x_1 + 2x_2 + 3x_3$ subject to $x_1 + 5x_2 + 3x_3 \leq 22,\ x_1 + 4x_2 + x_3 \geq 12,$
$x_1 + 2x_2 + 5x_3 \geq 14, x_1, x_2, x_3 \geq 0$

f. Solve the given LPP graphically
$Max\ Z = 30x + 40y$ subject to $x + y \leq 45, 2x + y \leq 60, x, y \geq 0$

3. **Attempt *any three* of the following:** 15

a. 3 factories A, B & C wants to dispatch their goods to 4 customers P, Q, R & S. Supply from factories is 500, 300 & 200 units & demand of customers are 180, 150, 350 & 320 units respectively. The cost per unit of transportation is given as follows. Find IBFS of given transportation problem by Matrix minima method.

	Customers [cost in Rs. per unit]			
Factories	**P**	**Q**	**R**	**S**
A	12	10	12	13
B	7	11	8	14
C	6	16	11	7

b. Find IBFS of the following transportation problem by North west corner rule Method Check whether solution is degenerate or non-degenerate.

	Distribution centres (Cost in '000 Rs. Per unit)				
Warehouses	**D1**	**D2**	**D3**	**D4**	**SUPPLY**
W1	6	3	5	4	**22**
W2	5	9	2	7	**15**
W3	5	7	8	6	**11**
DEMAND	**7**	**15**	**17**	**9**	

c. Write a short note: Prohibited Transportation Problem

d. Company has three warehouses & 3 distribution centres. The supply from each warehouse, demand at each distribution centre, associated transportation cost & from the past experience dispatch schedule of a company is as follows

	Distribution centres (Cost in '000 Rs. Per unit)			
Warehouses	**D1**	**D2**	**D3**	**Supply**
W1	(35) 6	(25)3	5	**60**
W2	(40)5	2	(40)2	**80**
W3	12	(85)7	8	**85**
DEMAND	**75**	**110**	**40**	

Answer the following questions:

i) Is the solution optimal or non-optimal? If the solution is optimal find minimum transportation cost

ii) Is there any alternate solution? If so, find it.

e. Find IBFS of given transportation problem by Vogel's Approximation Method

	Warehouses (Cost in '00 Rs. per unit of transportation			
Production plants	**W1**	**W2**	**W3**	**Production Capacity**
P1	6	10	4	**30**
P2	12	2	5	**32**
P3	11	8	8	**28**
Requirement	**18**	**22**	**50**	

f. Write a short note on: Unbalanced Maximization Transportation Problem

15

4. Attempt *any three* of the following:

a. Solve the following assignment problem to minimize total cost

		Machines (Cost in '000 Rs.)			
		X	Y	Z	W
Jobs	A	18	24	28	32
	B	8	13	17	19
	C	10	15	19	22

b. Write a short note on: Multiple solutions of Assignment Problem

c. Explain the terms: Balanced Assignment Problem, Regret Table. Support your answer with suitable example.

d. A computer center has four expert programmers and needs to develop four application programs. The head of the computer center has estimated the computer time (in days) required by the respective experts to develop the application programs as follows. Find the assignment pattern that minimizes the time required to develop the application programs.

		Programs (Time in days)			
		P1	P2	P3	P4
Programmer	A	120	100	80	90
	B	80	90	110	70
	C	110	140	120	100
	D	90	90	80	90

e. A company has a team of 4 salesmen & there are 4 districts where company wants to start its business. The following table gives the profit per day in '00 Rs. for each salesman in each district. Find the optimal assignment between salesman & districts to maximize total profit.

		Districts (Profit in '00 Rs.)			
		I	II	III	IV
Salesmen	S1	16	10	12	11
	S2	12	13	15	15
	S3	15	15	11	14
	S4	13	14	14	15

f. Solve the following assignment problem to minimize total duration

		Jobs (Time in days)				
		A	B	C	D	E
Machine	M1	9	11	15	10	11
	M2	12	9	-----	10	9
	M3	----	11	14	11	7
	M4	14	8	12	7	8

S.Y.B.Sc.D.S. Semester - IV

Subject: Customer Relationship Management.

Date: 17/03/2026 **Duration: 1 hour** **Marks: 30 marks**

Instructions for the candidate:

1. This question paper contains 1 page.
2. Q.1 is Compulsory.
3. Attempt any 2 from Q. 2 to Q.4.
4. Answers to each new question should begin on a fresh page.
5. Figures on the right-hand side indicate full marks.

Q 1 Style Hub Retail, a growing fashion brand with multiple outlets in Mumbai, had a large customer database but struggled to convert it into repeat sales. Although many customers visited the store and website, marketing campaigns showed low response rates. Management realized that sending the same offers to all customers was ineffective and lacked proper segmentation and targeting. 10 marks

Style Hub treated all customers as one group, leading to:
1.Irrelevant promotions being sent to customers.
2.Low engagement with emails and messages.
3.Poor use of customer data stored in the CRM system.
As a result, customers felt disconnected, and the CRM failed to support long-term relationships.
Questions:
Q.1) How can customer segmentation help Style Hub improve its CRM strategy?
Q.2) How can effective customer targeting increase customer loyalty through CRM?

Q 2 Answer the following

A Explain the challenges of data management. 5 marks

B What are the benefits of Digital CRM. 5 marks

Q 3 Answer the following

A Explain the steps in implementation of CRM. 5 marks

B Explain the types of loyal customers. 5 marks

Q 4 Answer the following

A Explain the CRM Value chain. 5 marks

B Explain the levels of E-CRM . 5 marks

S. Y. B. Sc. (D.S.) – Semester IV
SUBJECT: Probability Distributions
(Time: 1 hour)

18/03/2026

Total Marks: 30

N. B.: (1) **All** questions are **compulsory**.
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1. Attempt *any three* of the following: **15**

a. Determine whether probability mass function $P(X = x) = \frac{5x+1}{54}$ for $x = 1,2,3,4$ forms probability distribution. If yes, find its mean & variance

b. A continuous random variable X has following probability density function

$f(x) = kx^2(5 - x), \quad 0 < x < 1$
$= 0 \qquad\qquad$ otherwise

i) Find the value of k
ii) Find $P(0.3 < X \leq 0.75)$
iii) Find $P(X > 0.8)$

c. (X, pi) follows probability distribution given below.

X	2	4	6	8	9	10
pi	0.1	0.2	0.35	0.1	0.2	0.05

i) Find $P(X < 6)$
ii) Find mean of the distribution
iii) Find variance of the distribution

d. (X, pi) follows probability distribution given below.

X	1	2	3	4	5	6
pi	$4k$	k	$3k$	$2k$	$2k$	k

i) Find the value of k
ii) Find variance of the distribution

e. A continuous random variable X has following probability density function

$f(x) = \frac{2}{17}(3x + 4), \quad 1 < x \leq 2$
$= 0, \qquad\qquad$ otherwise

Find mean & variance of above distribution.

f. A continuous random variable X has following probability density function.

$f(x) = \frac{1}{2}x, \qquad 0 \leq x < 1$
$= \frac{1}{2}, \qquad 1 \leq x \leq 2$
$= \frac{1}{2}(3 - x) \quad 2 < x \leq 3$

i) Find $P(X < 1.8)$
ii) Find $P(0.1 < X \leq 1.5)$
iii) Find $P(X \geq 1.2)$

2. Attempt *any three* of the following: **15**

a. Telephone operator receives on an average 4 calls per hour. Find the probability that
- **i)** There are 3 calls per hr.
- **ii)** There are at most 2 calls per hr.
- **iii)** There are at least 3 calls per hr.

b. It is observed that probability of non-defective bulb is 0.7. If 6 bulbs are selected randomly from a box, find the probability that
- **i)** There are 4 non-defective bulbs
- **ii)** There are at least 4 non-defective bulbs
- **iii)** There are not more than 2 non-defective bulbs.

c. Daily sale of a firm is normally distributed with mean Rs.8,000 & standard deviation Rs.100.
- **i)** What is the probability that on a certain day sale will less than Rs.8,210?
- **ii)** What is % of days on which sale will be between Rs.7,800 & Rs.8,250?

d. Discrete random variable X follows binomial distribution with mean 7.5 & variance 1.875.
- **i)** Find $n,\ p,\ q$
- **ii)** Find $P(X < 2)$

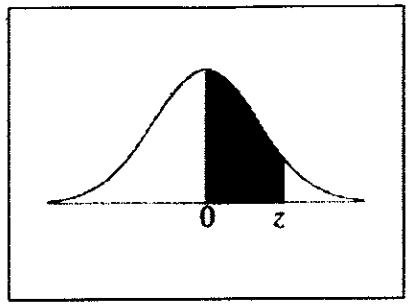
e. A box contains numbered tickets 1 to 7. If one ticket is selected randomly,
- **i)** What is the probability of each out come?
- **ii)** Calculate mean & variance of distribution

f. Continuous random variable X is uniformly distributed over the interval $[a, b]$. State & prove the formula to find mean & variance of the distribution.

S. Y. B. Sc. (D.S.) – Semester IV

SUBJECT: Probability Distributions

Standard Normal Distribution Table



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998