2nd Year B. Sc. First Semester Final Examination 2015

Department of Computer Science and Engineering

University of Dhaka

BUS-2123: Introduction to Business

Total Marks: 60 **Time: 2.5 Hours**

Answer any four (4) questions.

1. a) Why do firms become involved in international business? 4

   b) How does a country use import tariffs to restrict international business? 2

   c) Explain the different approaches a firm can take to conduct business internationally. 9

2. a) What do you mean by sole proprietorship business? What are the major characteristics of sole proprietorship business? Discuss 8

   b) What is the form of corporation business? What are the major advantages and disadvantages of this form of business? Explain. 7

3. a) What do you mean by franchising? What are the major characteristics of franchise business? 6

   b) Determine small business. What factors are responsible for small business failure? Explain. 5

   c) ~~Why~~ do a domestic firm involve in international business? Briefly explain. 4

   How

4. a) What types of role does a manager need to perform to be successful in an organization? Discuss. 6

   b) What is management? What are the basic functions of management? Discuss. 5

   c) Make a difference between line authority and staff authority. 4

5. a) What is marketing? How do marketing functions add value to the product? Explain. 5

   b) What is marketing mix? What are the elements of marketing mix? Discuss. 5

   c) Briefly explain the various steps of marketing research process. 5

6. a) What is consumer product? Explain different types consumer products with proper examples. 5

   b) Explain the different stages of product life cycle. 5

   c) Explain the different methods of pricing. 5

2nd Year B. Sc. First Semester Final Examination 2015

Department of Computer Science and Engineering

University of Dhaka

MTM-2121: Ordinary Differential Equation

Total Marks: 60 **Time: 2.5 Hours**

Answer any four (4) questions.

1. a) Explain the order and degree of a differential equation. Find the degree and order of the following differential equations. 5

i) $\left(\frac{dr}{ds}\right)^3 = \sqrt{\frac{d^4r}{ds^4} + 2}$ ii) $\left(\frac{d^2y}{dx^2}\right)^{\frac{1}{4}} = k + \left(\frac{dy}{dx}\right)^2$

b) Formulate the differential equation of a circle which passes through the origin 5

c) Use necessary and sufficient condition for exactness to solve the ODE: 5

$$(2x\cos y + 3x^2 y)dx + (x^3 - x^2 \sin y - y)dy = 0$$

2. a) Explain the method of variation of parameters. 8

b) Solve $\frac{d^2y}{dx^2} + 4y = 4\tan 2x$ 7

3. a) Find the general solution of Bernoulli's equation 8

$\frac{dy}{dx} + Py = Qy^n, n \neq 1$ where P and Q are only functions of x or constatnts.

Solve the following equation

$$\frac{1}{y^2}\frac{dy}{dx} + \frac{1}{xy} = \frac{1}{x^2}$$

b) A fossilized bone is found to contain $\frac{1}{1000}$ of the original amount of carbon. Determine the age of the fossil. Assume that the half life of carbon is 5600 years. 7

4. Solve the following initial value problems. 15

i) $2x^3y' = y(y^2 + 3x^2), \quad y(1) = 1$

ii) $y'' - y' - 6y = 8e^{2x} - 5e^{3x}, \; y(0) = 3, y'(0) = 5$

5. a) State and prove Euler's equation. Find the general solution of the differential equation

$$x^2y'' - 3xy' + 3y = 2x^4e^x$$

b) If $y = x$ is a solution of the differential equation $x^2y'' - 4xy' + 4y = 0$, find a linearly independent solution by reducing the order. Write the general solution. 7

6. a) Find the general solution of the system 8

$$\frac{dx}{dt} = 4x - y, \quad \frac{dy}{dt} = x + 2y$$

b) Find the general solution of the system

$$\frac{dx}{dt} = 3x + 2y, \quad \frac{dy}{dt} = -5x + y$$

2nd Year B. Sc. First Semester Final Examination 2015
Department of Computer Science and Engineering
University of Dhaka
CSE 2101 : Data Structure

Time 2.5 hours
Full Marks 60

Answer any 4 (Four) of the following questions.

1. a) Analyze the time complexity of the function below and express it in big-Oh notation. How many iterations are necessary if N = 1000? 5

```
void function(int N, int a[])
{
        int sum = 0;
        for(int i = 0; i < N; i ++)
        {
                sum += a[i];
                i = i * 4;
        }
}
```

b) Suppose you are running a shop where you prepare two types of cakes for your customers - **chocolate cake** and **fruit cake**. 5

i. Fruit cake has a special quality that, the longer you keep it after preparing, the better it tastes.

ii. On the other hand, chocolate cakes are best served just after being prepared.

When a customer arrives at your shop, he tells you which type of cake he wants. Of course he wants the **best cake** for his **required type** that is available at that time in your shop. Moreover, you cannot waste time for searching the best cake; you have to give the best cake to the customer instantly. State which data structure you will choose to store each type of cakes. Explain why.

c) Evaluate the following postfix expression using Stack. 5

20 7 3 2 * + - 12 6 / +

2. a) How can you implement a queue using singly linked list? Write the ENQUEUE and DEQUEUE functions of your QUEUE ADT. You can safely assume that the LINKED-LIST ADT is provided with necessary common functions. 5

b) Write a procedure **SORT** which sorts a singly linked list without changing any value of an element of list. Your required assumptions must be clearly stated. 5

c) Write a recursive function that determines whether a string is a palindrome. The skeleton of your code is given below: 5

```
char a[1000];
int isPalindrome(int startIndex, int endIndex)
{
        // Write your code here.
        // ..
        // the function should return 1 if a is palindrome
        // the function should return 0 if a is not palindrome
}
```

3. a) What will be the steps to merge the following two sorted arrays to make a merged sorted array? Show each steps with the followings: 5

i. Left Array Index

ii. Right Array Index

iii. Merged Array Contents

iv. The two elements that are being compared

Left_Array : [5, 7, 10, 12, 18, 22, 25]
Right_Array: [3, 4, 6, 14, 15, 19, 30, 32]

b) Quick sort and merge sort both consist of three basic steps. Mention the steps and the activities involved in the both sorting algorithms. 5

c) Give the result of partitioning the following array with standard Quick sort partitioning (taking N at the left as the pivot). Show intermediate steps of this partitioning. 5

N O P A R T I T I O N I N G B U G S

4. a) Define Binary Search Tree (BST). Perform the following operations on an initially empty BST. Show BST after each step. 5

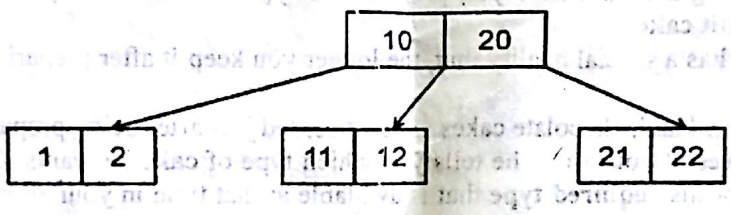
i.	Insert 10	ii.	Insert 5	iii.	Insert 8
iv.	Insert 6	v.	Insert 18	vi.	Insert 25
vii.	Insert 4	viii.	Insert 20	ix.	Delete 18
x.	Delete 5	xi.	Delete 6	xii.	Delete 10

b) Suppose we know the preorder and postorder traversal sequences of a binary tree T. Let the preorder traversal sequence of T be **100, 34, 16, 9, 8, 38, 11, 4, 81** and postorder traversal sequence be **34, 9, 11, 4, 38, 81, 8, 16, 100**. If all the non-leaf nodes of T have two children, identify T. 5

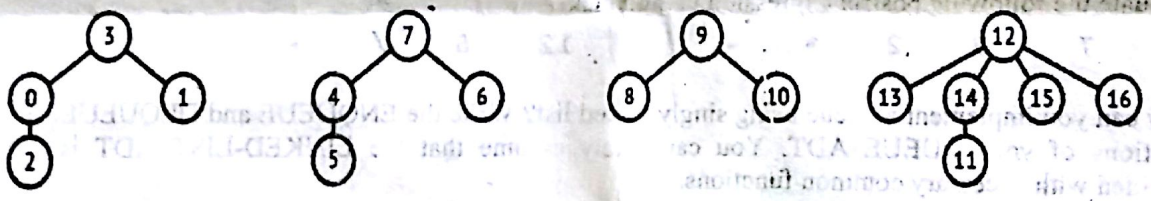
c) Illustrate the operations of HEAPSORT on the array **[5, 13, 2, 25, 7, 17, 20, 8, 4]**. 5

5. a) Consider the AVL tree below. Show how 16 will be inserted in this tree. Perform necessary balancing actions (rotations). 5

b) Consider a 3-ary B-Tree below. Show steps after Inserting 25 to the B-Tree. 5



c) Consider the Disjoint Set structure built so far below. If path-compression technique is used, and **findRoot()** is called for every node, then for which nodes, path compression will actually occur (parent will be updated)? 5



6. a) i. What is hash function? Name two desirable properties of a hash function. 5
ii. What is the clustering problem in hash tables?

b) Draw a hash table with chaining and a size of 9. Use the hash function "**h(k) = k%9**" to insert the keys **5, 29, 20, 0** and **18** into your table. 5

c) What are the different approaches to represent a graph into memory? Describe two of them with example. 5

2nd year 1st semester B.Sc. Final Exam 2015
Department of Computer Science and Engineering
University of Dhaka
CSE 2103: Computer Architecture

Time 2.5 hours
Full Marks 60

Answer any 4 (Four) of the following questions.

1. (a) What is addressing mode? What is the difference between relative and direct addressing? Explain the following addressing modes with example. 5
   i. Register Direct addressing
   ii. Auto Indexing

   (b) Consider two different implementations, P1 and P2, of the same instruction set. There are five classes of instructions (A, B, C, D, and E) in the instruction set. P1 has a clock rate of 5 GHz. P2 has a clock rate of 4 GHz. The average number of cycles for each instruction class for P1 and P2 is as follows: 5

Class	CPI on P1	CPI on P2
A	1	2
B	2	2
C	3	2
D	4	4
E	5	4

   Assume that peak performance is defined as the fastest rate that a computer can execute any instruction sequence. What are the peak performances of P1 and P2 expressed in instructions per second?

   (c) Construct a table to multiply 14 times -5 using 5-bit numbers using Booth's algorithm. 3

   (d) Define normalization and biasing with example. 2

2. (a) Draw the pipelined adder for floating point numbers. Show the steps needed to calculate the summation of 6 floating point numbers: b_1, b_2, b_3, b_4, b_5 and b_6. 3+4

   (b) Explain the advantage of carry save addition using a suitable example. 3

   (c) Describe the working principal of a carry look ahead adder. What are the disadvantages of a carry lookahead adder? 5

3. (a) What is the equivalent one-address machine code of **(A+B+C)/(A-B*C)** 3

   (b) Describe the working principal of a 4-bit Magnitude Comparator. 5

   (c) Consider the computer with three instruction classes and CPI measurements of **Table 1**. Now suppose we measure the code for the same program from two different compilers and obtain the data of **Table 2**. 2+2

Instruction Class	CPI
A	1
B	2
C	3

Table 1

Code from	Instruction counts (in billions) for each instruction class		
	A	B	C
Compiler 1	5	1	1
Compiler 2	10	1	1

Table 2

   Assume that the computer's clock rate is 4 GHz. Which code sequence will execute faster:
   i. according to MIPS (million instructions per second)?
   ii. according to execution time?

   (d) What are the pros and cons of a stack based architecture? 3

4. (a) Draw the block diagram of a single cycle processor datapath with necessary control signals. Highlight the datapath in the figure involved in operation for a load instruction. 5

(b) Write down the fast code for executing the following instructions to avoid Load hazards. 3

a = b + c;

d = e – f; assume a, b, c, d ,e, and f in memory.

(c) Describe the role of ALU control in Simple Datapath Control Unit. 3

(d) Suppose dividend X =1100 and divisor Y =0011. Write down the steps needed to divide X by Y. 4

5. (a) Describe the techniques of handling write operation in cache memory. 5

(b) How many bits are required for a direct-mapped cache with 32 KB of data and 4 word blocks, assuming a 32 bit address? 2

(c) Here is a series of address references given as word addresses: 0, 8, 15, 3, 7, 6. Assume that cache size is four one-word blocks which are initially empty. Label each reference in the list as a hit or miss and show the final cache contents in case of direct mapped, 2-way set associative, and fully associative cache replacement algorithm. 5

(d) Explain data hazard in pipelining along with its solution. 3

6. (a) Compare different types of bus arbitration methods. 4

(b) Describe the working principal of Direct Memory Access (DMA). How single -line interrupt system works? 4

(c) Write down the basic characteristics of systolic array. Name some arithmetic operations that can be implemented using systolic arrays. 4

(d) Describe different types of ALU expansion techniques. 3

2nd Year B. Sc. First Semester Final Examination 2015
Department of Computer Science and Engineering
University of Dhaka
CSE 2102 : Object Oriented Programming

Time 2.5 hours
Full Marks 60

Answer any 4 (Four) of the following questions.

1. a) Consider the following statement 3

```
public static void main(String args[])
```

Describe why the main method should always be public and static?

b) Define following points from Object Oriented Programming Point of view: 4

- Objects and classes
- Data Encapsulation
- Polymorphism
- Dynamic Binding

c) What will be the output of the following program? 2

```
class test{
  int range = 1;
  void start() {
    for ( int i=0; i<range; i++)
      System.out.print(i + " ");
    System.out.println("");
    range++;
  }
```

```
public static void main(String args[]) {
    test ct = new test();
    for(int i=1;i<=5;i++)
      ct.start();
  }
```

d) Describe the concept of **Life Time** and Scope of a variable with suitable example. 3

e) Create a class **OCT** and create two objects of that class. First object will be treated as square by sending the length/width of the square and second one will be treated as rectangle by sending length and width of the rectangle. Define constructor(s) in such a way that can initialize object according to the given description. Define another method to calculate the area of the object and also print the area within same method. 3

2. a) What will be the output of the following program? Also write down the reasons behind writing the values. 4

```
public class Interesting {
    private int a = 10;
    private static int b = 10;
    public void increment() {
        a++;
        b++;
    }
    public printing() {
        System.out.println(a+' '+b);
    }
}
```

```
public class Main {
public static void main (String[] args) {
        Interesting s = new Interesting();
        Interesting t = new Interesting();
        s.increment();
        t.increment();
        t.increment();

        s.printing();
        t.printing();
    }
}
```

b) Find the errors (compile error and logical error) of the following Java code and propose a correction. 6

```
class test{
int x;
    test(){
        x = 0;
    }
    test(){
        x = 10;
    }
    test(int x){
        x = x;
    }
    void print(){
        System.out.println(x);
    }
}
```

```
public class Main {
    public static void main(String[] args) {
        test ob = new test();
        ob.print();
    }
}
```

c) What is **Constructor** function? What are the features of this function? 3

d) Write a short program to demonstrate the concept of "**this**". 2

3. a) Write a java class ***Fraction***, which represents fractions of the form a/b, where a and b are integers (i.e. 1/2, 4/6, 101/531 etc.). Use ***int*** to store numerator and denominator. Include a constructor that initializes from numerator and denominator parameters. Include another default constructor which initializes numerator and denominators to 1. Write an instance method for addition [Hint: a/b + c/d = (ad+bc)/bd]. Write an instance method for multiplication [Hint: a/b*c/d = ~~ab/cd~~ ac/bd]. Override the **toString()** method which will return the fraction as a string a/b. 7

Also create a Main class consist of the main method and show the use of Fraction class.

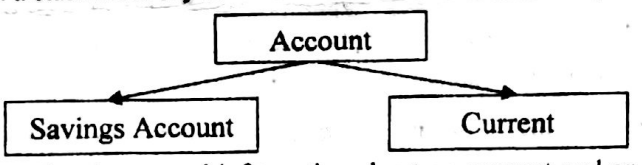
b) Find the output of the following java code and explain the output. 3

```
class A{
        void print(){
                System.out.println("Inside Class A");
        }
}
class B extends A{
        void print(){
                System.out.println("Inside Class B");
    }
}
public class Main {
    public static void main(String[] args){
        A ob1, ob2;
        ob1 = new B();
        ob2 = new A();
        ob1.print();
        ob2.print();
    }
}
```

c) Describe about default initialization of a variable inside a method and inside a class in Java. 3

d) Differentiate between the terms **Overloading** and **Overriding**. 2

4. a) You have to design a class hierarchy as shown below in a Java program: 10



The parent class contains the general information about an account and an abstract method to calculate the yearly interest. For savings account, the interest rate is 15% and for current account the interest rate is 8%. All the data members of the Account class are initialized through a parameterized constructor. Your program should be able to deposit and withdraw money from a saving account. Perform the same operation on a current account.

b) Given the main method of a Java program. 5

```
public static void main(String[] args){
        int a[] = new int[5], x = 0;
        Scanner sc = new Scanner(System.in);
        try{
                x = sc.nextInt();
                int y = 10 / x;
                a[x] = 10;
                System.out.println("No Exception Occurred");
        }
        catch(ArrayIndexOutOfBoundsException e){
                System.out.println("Exception Occured at Index: "+ x );
        }
        catch(ArithmeticException e){
                System.out.println("Exception Occurred: Divide by zero");
        }
}
```

What is the output of the code given above with the input given as follows

i. x = 10

ii. x = 3

iii. x = 0

5. a) Consider the following interface 6

```
interface Sorting{
        boolean compare(Object s, Object t);
}
```

Define two different classes which implements ***Sorting***:

1. ***Shorter***, which has a compare method which returns true if *s* is shorter than *t* and false otherwise. Typecast *s* and *t* to Integer objects to compare.
2. ***Alphabetic***, which has a compare method which returns true if *s* would come before *t* in a dictionary and false otherwise. Typecast *s* and *t* to String objects to compare.

b) Describe scope of public, private, protected and default access modifiers. 2

c) Consider the following program. Find out the error (if any), and correct it by mentioning the reason. Show the output. 4

```
class Book{
        public int page;
        void msg(){
                System.out.println("Number of pages: " + pages);
        }
}
class Dictionary extends Book{
        public int def ;
        void defMsg(){
                System.out.println("Number of definitions: " +def);
                System.out.println("Definitions per page: " +(def/page));
    }
}
class test{
        public static void main (String args[]){
                Dictionary D = new Dictionary();
                D.page = 1500;
                D.definition = 52500;
                Book B = new Book();
                B=D;
                B .page = 1300;
                B.def = 34500;
        }
}
```

→ D.defMsg();
B.defMsg();

d) What are the purposes of using **super** in JAVA? Discuss with examples. 3

6. a) Write a multithreaded Java program to find all the prime numbers from 1 to 100,000,000. Create five threads and distribute the range amongst them to calculate the result. Main thread should wait for the other threads to terminate. Note that, a number **n** is prime number if it is divisible by only 1 and **n**. 6

b) What is **anonymous inner class**? What is the difference between **event listener** and **event adapter**? 1+2

c) What is **applet**? Describe life cycle of an applet. 1+2

d) What are the two ways to create a **thread**? Which one way is better than other one? Explain briefly. 3

2nd year 1st semester B.Sc. Final Exam 2015

Department of Computer Science and Engineering

University of Dhaka

STAT 2122: Introduction to Probability

Time 2.5 hours

Full Marks 60

Answer any 4 (Four) of the following questions.

1. (a) Which of the following pairs of events are mutually exclusive? 3
(i) A football team losing the first game of a tournament and losing the tournament.
(ii) A poker player getting a flush (all cards in the same suit) and 3 of a kind on the same 5-card hand.
(iii)A tennis player losing the last game and winning the match.

(b) A bag contains 6 red balls, 5 yellow balls, and 3 green balls. Two balls are drawn at random. 3
What is the probability that
(i) both balls are yellow?
(ii) no green ball is selected?
(iii) one red ball is selected?

(c) Prove that the number of different arrangements of *n objects consisting of k* similar objects of 4
one type and *n – k similar objects of a second type is given by* $C_{n,k}$.

(d) Three cards are drawn in succession, without replacement, from an ordinary deck of playing 5
cards. Find the probability that the event $A_1 \cap A_2 \cap A_3$ occurs, where A_1 is the event that the first card is a red ace, A_2 is the event that the second card is a 10 or a jack, and A_3 is the event that the third card is greater than 3 but less than 7.

2. (a) A committee of 3 members is selected from 4 men and 2 women. The random variable X is the 4
number of men in the committee. Find the mean and variance of X.

(b) The life-time X, in hours, of a certain type of electronic component has a density function given 3
by

$$f(x) = \begin{cases} 0, x < 100 \\ \frac{100}{x^2}, x \geq 100 \end{cases}$$

Determine the probability that a component will survive 150 hours of operation, given that the component survives at 120 hours of operation.

(c) Show that if $X_1, X_2, \ldots, X_n$ are independent random variable and have are identically distributed as 4
Bernoulli(p), $X_1 + X_2 + \ldots + X_n \sim$ Binomial(n,p).

(d) What do you understand by the term "Explaining Away" in relation to computing conditional 4
probabilities? Give an example.

3. (a) Write down the maximum a posteriori formulation to find the best hypothesis? Derive it from 5
Bayes' theorem.

(b) Let X be a random variable with pdf $f(x) = \frac{x^2}{3}$, *when* $1 \leq x \leq -2$. Let Y = 4X+3. Find E[Y] and 5
Var[Y].

(c) Consider a quiz contest where a person is given two questions and must decide which one to 5
answer first. Question 1 will be answered correctly with probability 0.8, and the person will then receive 1000tk, while question 2 will be answered correctly with probability 0.5, and the person will then receive a prize of 2000tk. If the first question attempted is answered incorrectly, the quiz terminates, i.e., the person is not allowed to attempt the 2nd question. If the first question is answered correctly, the person is allowed to attempt the 2nd question. Which question should be answered first to maximize the expected value of the total prize money received?

4. (a) Consider the following pmf, $P(X = x) = f(x) = \frac{1}{a^{x+1}}$, where $R_X = \{0,1,2,\ldots\}$ and $a > 1$. 8
(i) Show $\sum f(x) = 1$
(ii) Sketch the graph of f(x) and F(x)
(ii) Find the moment generating function, $m_x(t)$
(iii) Find E[X] and Var[X] using $m_X(t)$ 2

(b) Show that if X ~ Exponential(λ) then X ~ Gamma(1, λ) 5

(c) Show that E[X] = r/p where, X ~ Negative Binomial(r,p). 6

5. (a) Let X and Y be continuous random variables with joint probability density function

$$f(x,y) = 2xy + \frac{3}{2}y^2, 0 < x < 1, 0 < y < 1$$

(i) Test whether X and Y are independent.
(ii) Find P(0 < X < 0.5 | Y = 0.3).
(iii) Evaluate E[X | Y = 0.3].

(b) What are the assumptions of binomial distribution? Is it possible to have a binomial distribution 3
with mean 5 and standard deviation 2.4? Why?

(c) Define hypergeometric distribution. Compare binomial and hypergeometric distribution with an example. 3

(d) A and B play a game in which A's chance of winning is 0.67. In a series of 10 games, what is the probability that A will win (i) exactly 5 games, (ii) at least 2 games. 3

6. (a) Suppose it is known that of the articles produced by a factory, 20% come from Machine A, 30% come from Machine B, and the rest come from Machine C. The percentages of satisfactory articles among those produced are 95% for A, 85% for B, and 90% for C. An article is chosen at random. 5

(i) What is the probability that it is satisfactory?

(ii) Assuming that the article is satisfactory, what is the probability that is was produced by Machine C?

(b) What are the steps to determine whether your data is Normally distributed? 4

(c) Suppose scores on a standard IQ Test for people aged 20 to 34 are normally distributed with mean 110 and standard deviation 25. 6

(i) What is the probability that a young adult will score above 180 on this IQ Test?

(ii) What is the probability that a young adult will score between 85 and 160 on this IQ Test?

(iii) How much do you have to score to be in the top 10% of on this intelligence scale?

The Standard Normal Probability tables are provided in the following pages.

Standard Normal Probabilities

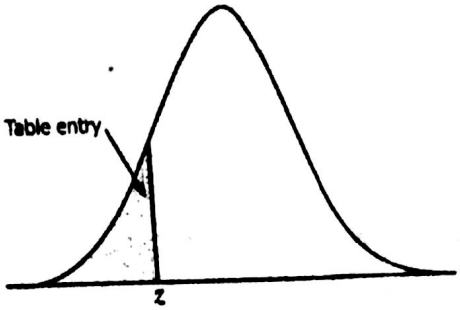


Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

Standard Normal Probabilities

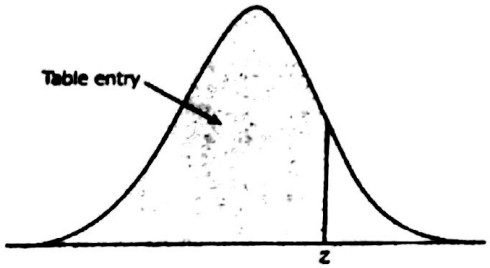


Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998