University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination **Spring-2023** **2nd year 1st Semester**

Course Code: CSE 203 Course Title: Object-Oriented Programming I: Java Credit: 3

Time: 3.00 Hours. Full Mark: 50

There are **Five** Questions. Answer all of them. Part marks are shown in the margins.

1. a. Polymorphism is one of the key features of OOP. Explain how polymorphism can be achieved in Java. **[6]** **[CO1]**

b. Differentiate between abstract classes and interfaces in Java. **[4]** **[CO1]**

2. a. Write a Java program which takes the user's name, height in meters, and weight in kilograms and calculates their BMI (Body Mass Index). The equation to calculate BMI is: **[5]** **[CO2]**

$$BMI = weight / (height)^2$$

After calculating the BMI of the user, provide a welcome message to the user with his/her name and show their BMI range according to the chart given below:

Underweight	BMI < 18.5
Normal weight	18.5 ≤ BMI < 24.9
Overweight	25 ≤ BMI < 29.9
Obesity I	30 ≤ BMI < 34.9
Obesity II	35 ≤ BMI < 39.9
Obesity III (Morbidly obese)	BMI ≥ 40

b. Write a Java program which takes user input to create an integer array and returns the sum and average of the array elements. **[5]** **[CO2]**

3 a. Create an abstract class **Phone.** Add 3 attributes: ***manufacturer***, ***storage***, and ***batteryPower***. Create a constructor that will take parameters for all attributes and initialize the respective attributes. Add the following methods to this class. **[6]** **[CO3]**

- ***public void call(String toPhNum)***
- Inside the method, print "Calling **toPhNum**" where **toPhNum** is the parameter
- ***public void sendMessage(String toPhNum, String msg)***
- Inside the method, print the msg parameter and then print "Message sent to **toPhNum**" where **toPhNum** is the parameter.

b. Create a **concrete** subclass "**SmartPhone**" of the above abstract class **Phone (Q#3a)** and also implement the **SmartDevice** interface below. Add an additional attribute, ***os*** (Operating System) to this class. Create a constructor that will take parameters for all 4 attributes and initialize the respective attributes properly. Override the necessary methods. Add an overloaded method of the ***call()*** method of the parent class. In the overloaded **call()**, pass an **additional** parameter **"usingApp"** to pass the name of the app such as WhatsApp, Messenger, etc. Inside the ***call*** method, call the ***runApp(...)*** method and pass the **usingApp,** and then call the ***call(...)*** method of the parent class. **[4]** **[CO3]**

```
public interface SmartDevice {
      void runApp(String appName);
}
```

4. a. Assume there is an **abstract** parent class "**Student**" which has an attribute ***highestCgpa***. **Student** class has 2 subclasses: "**UnderGraduateStudent**" and "**GraduateStudent**". **[5]** **[CO3]**

Now, declare a static method named **setHighestCgpa** (Assume the method is inside the **UAP** class) which will take only one parameter that can hold both an **UnderGraduateStudent** object and a **GraduateStudent** object. Inside the method set the ***highestCgpa*** to 4 if the parameter is an object of the **UnderGraduateStudent** class or to 5 if it is a **GraduateStudent** object. For example, in the code segment below, the first method call will set the ***highestCgpa*** of that student to 4 and the second method call will set the ***highestCgpa*** of that Graduate student to 5.

```
UAP.setHighestCgpa(new UnderGraduateStudent());//this sets highestCgpa to 4
UAP.setHighestCgpa(new GraduateStudent()); //this sets the highestCgpa to 5
```

b. Carefully observe the code of the **BankAccount** class and **SouthEastBank** class below. Identify the **errors** in the code below and fix the errors. You are not allowed to delete any line of code. You can only add new lines or edit existing lines. Write the output after fixing the errors. **[5] [CO4]**

```
1  package sp23final;
2
3  public class BankAccount {
4      String name, accNum;
5      private double balance;
6      public BankAccount(String name, String accNum, double bal) {
7          this.name = name;
8          this.accNum = accNum;
9          this.balance = bal;
10     }
11
12     public void deposit(double amt) {
13         balance += amt;
14     }
15
16     public void withdraw(double amt) {
17         balance += amt;
18     }
19
20     public void display() {
21         System.out.println(this.name+":"+accNum+":"+balance);
22     }
23 }
```

```
1  package sp23final;
2
3  public class SouthEastBank {
4
5      public static void main(String[] args) {
6          BankAccount b1 = new BankAccount("Mahi", "11111", 1000);
7          BankAccount b2 = new BankAccount("Arnob", "22222");
8          transfer(b1, b2, 500);
9          b1.display();
10         b2.display();
11
12     }
13
14     public void transer(BankAccount a1, BankAccount a2, double amt) {
15         a1 = new BankAccount("Rafi", "33333", 2000);
16         a1.withdraw(amt);
17         a2.deposit(amt);
18         System.out.println(a2.balance);
19     }
20 }
21
```

5. **Answer (a,b) or (c,d)**

a. Create a user-defined exception named **InvalidTemperatureRangeException** that takes two parameters, **minTemp** and **maxTemp**, in the constructor. Inside the constructor, set the exception message to "Temperature should be between **minTemp** and **maxTemp** degrees." **[4]** **[CO5]**

b. Define a static method "**runAirCooler**" which will take a parameter ***temp***. Inside the method, if the ***temp*** is between 10 to 28, print "Running at ***temp***". Otherwise, throw the **InvalidTemparatureException (Q5a)** and pass 10 and 28 as the value of **minTemp** and **maxTemp**. **[6]** **[CO5]**

Now from the main method, call the **runAirCooler** method twice and pass 15 and 30 respectively. Take appropriate measures in the main method to handle the exception properly.

Or

c. Create a multi-threaded program running 3 threads in parallel. Create the threads by **implementing** the **Runnable** interface. Each Thread will take 3 integers: **n, min,** and **max,** generate **n** random numbers between **min** and **max,** and **print** those numbers. The **first** thread will print 10 random numbers between **1 to 100, 2nd thread** will print 5 random numbers from **101 to 200,** and **3rd thread** will print 8 random numbers from **201 to 300**. **[5]** **[CO5]**

Note: Do not create 3 different classes for 3 threads, rather create one class and pass different parameters for different threads.

d. Assume your OOP course teacher is storing the final scores (out of 100) in a txt file where each line contains the **id** of the student followed by the score as shown in the sample file below. Write a Java program to read the file (one line at a time), determine if the student has passed or failed, and write that info in the Console. Sample input and output are given below. **[5]** **[CO5]**

Sample input file	Expected output
22101001 90	22101001 P
22101002 80	22101002 P
22201005 45	22201005 P
22201007 88	22201007 P
22201017 20	22201017 F
22201019 40	22201019 P

University of Asia Pacific

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Final Examination | **Spring-2023** | **2nd year 1st Semester**

Course Code: CSE 205 | Course Title: Data Structures | Credit: 3.0

Time: 3.00 Hours | Full Mark: 50

There are **Five** Questions. Answer all of them. Part marks are shown in the margins.

1. a. Suppose you are a programmer and your client want a system where s/he needs to search for items frequently. Choose a data structure and describe the searching algorithm that makes frequent search easy with examples. **[3] [CO1]**

   b. The Alumni association of UAP is going to organize a reunion soon. There will be approximately 1000 participants. Now you need to sort the ages of the alumni. Write the asymptotically fastest sorting algorithm that can sort the 1000 ages in efficient manner. Explain the time complexity of your chosen algorithm in best, average and worst scenario? **[7] [CO3]**

2. A computer network is defined as a system that connects two or more computing devices for transmitting and sharing information. For this purpose, there are several topologies available where **'Ring'** is one of them. In ring topology, a computer can forward data packets through another computer in bi-directional mode (both ways). Now, as a computer network architect, you are being asked to design such a system based on the following figure 1-

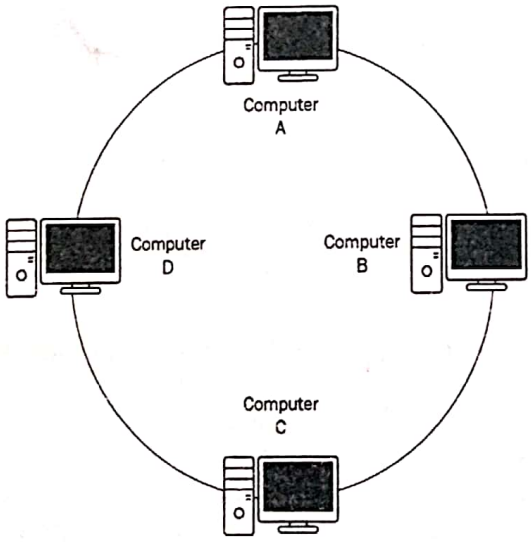


Figure 1

a. Identify which data structure will be better for this scenario and describe the reasons? [3] [C

b. Show any three basic operations of your chosen data structure to illustrate the above stated scenario using pseudocode/algorithm and necessary diagram. [7] [CO2]

3. a. Explain the requirements of a Recursive Solution? [3] [CO4]

b. The greatest common divisor (GCD) of two or more numbers is the greatest common factor number that divides them, exactly. Suppose, 4, 8 and 16 are three numbers. Then the factors of 4, 8 and 16 are: [2.5 + 2.5 + 2 = 7] [CO4]

4 → 1,2,4

8 → 1,2,4,8

16 → 1,2,4,8,16

Therefore, we can conclude that 4 is the highest common factor among all three numbers.

i. Write down a pseudocode/algorithm that involves iterative approach while computing the GCD of two numbers. Illustrate your solution using one example.

ii. Write down a pseudocode/algorithm that involves recursion while computing the GCD of two numbers. Illustrate your solution using one example.

iii. Compare between the iterative and recursive approach and explain according to you which one is better.

4. a. Write the pseudocode to find out the successor of a given key value **x** in a Binary Search Tree (BST). [3] [CO2]

b. Suppose the following ten key values are inserted into an empty binary tree in order: [7] [CO2]

50,33, 44, 22, 77, 35, 60,40, 85, 20

Now, perform the following operations:

i. Delete value 50

ii. Insert value 38

Show the partial tree after doing each operation (insertion and deletion).

5. Uber is a ridesharing company based on the Google map that allows passengers to hire a ride and drivers to charge fares and get paid. For calculating the price this system must have the possible traversal pathways, traffic status update as well as available transports. Now consider the following map (Figure 2) where node 'U' is the UAP City Campus, Farmgate (source) and node 'A' is Hazrat Shahjalal International Airport, Uttara (destination). Now consider yourself as an app developer of Uber, so before starting the ride you need to traverse the map-

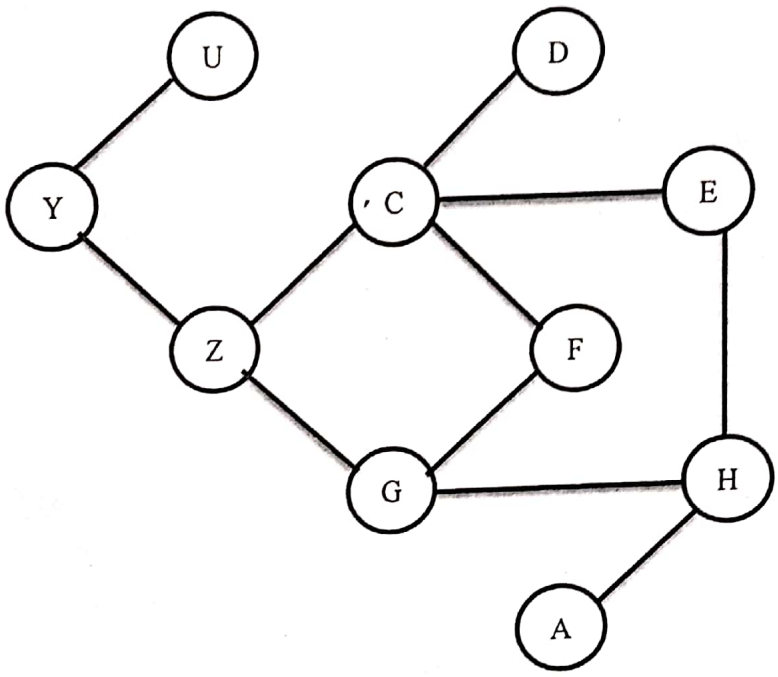


Figure 2

a. Write down the algorithm of BFS. **[3] [CO1]**

b. Show necessary iterations and appropriate data structure (stack/queue) operations that are needed for BFS traversal. **[7] [CO2]**

OR

a. Write down the algorithm of DFS. **[3] [CO1]**

b. Show necessary iterations and appropriate data structure (stack/queue) operations that are needed for DFS traversal. **[7] [CO2]**

University of Asia Pacific

Semester Final Examination Spring - 2023

Program: B. Sc. Engineering (2nd Year / 1st Semester)

Course Title: Electrical & Electronic Engineering II Course No: EEE 221 Credits: 4.00

Time: 3.00 Hours. Full Marks: 50

[There are FIVE Questions. Answer all of them. Part marks are shown in the margins]

1.	a.	Construct the circuit for the logic function, $F = \bar{A}B(C + \bar{D})$ using RTL and CMOS design techniques.	[5]	CO3
	b.	Draw the block diagram and logic flow/tree diagram of a 3 bits Successive Approximation ADC (Analog to Digital Converter). If the analog input voltage is 4.2 V, find the digital output.	[5]	CO3
2.	a.	For Astable operation of 555 timer show that, frequency, $f = \frac{1.45}{(R_A+2R_B)C}$ with necessary diagrams.	[7]	CO2
	b.	Design an Astable multivibrator having an output frequency of 2 kHz with a duty cycle of 65%.	[3]	CO2
		OR		
	a.	Design a triangular wave generator with a frequency of 3 kHz and draw output waveform.	[5]	CO2
	b.	Design a square wave generator using op-amp with a frequency of 4 kHz.	[5]	CO2
3.	a.	What is back e.m.f.? Is there any relation between back e.m.f. and armature current? Why is a starter circuit required for a DC Motor?	[2+2+2]	CO2
	b.	A DC motor takes an armature current of 100A at 450V. The armature circuit resistance is 2.5Ω. The machine has 6-poles and the armature is wave-connected with 850 conductors. The flux per pole is 0.05Wb. Calculate (i) the speed, (ii) the gross torque developed by the armature.	[4]	CO2
4.	a.	State the applications of relay and solenoid. Explain with necessary schematic how a bipolar stepper motor can be controlled?	[2+4]	CO2
	b.	The number of stator teeth in a variable reluctance stepper motor is 16 and the number of rotor teeth is 8. Calculate the stepping angle and resolution of the motor.	[4]	CO2
5.	a.	A step-down transformer with a turns ratio 1/8 is used with an electric train to reduce the voltage from the wall receptacle 120 V to a value needed to operate the train. When the train is running, the current in the secondary coil is 3.4 A. What is the voltage required to operate the train and the current in the primary coil?	[5]	CO2
	b.	A short-shunt compound generator delivers a load current of 30 A at 220 V, and has armature, series-field and shunt-field resistances of 0.05 Ω, 0.30 Ω and 200 Ω respectively. Calculate the induced e.m.f. and the armature current. Allow 1.0 V per brush for contact drop.	[5]	CO2

University of Asia Pacific

Department of Basic Sciences and Humanities

Program: B.Sc. in CSE

Final Examination **Spring-2023** **2nd Year 1st Semester**

Course Code: MTH 201 Course Title: Math III: Multivariable Calculus Credit: 3.00

Time: 3.00 Hours Full Marks: 50

There are **five** questions. Answer all of them. Part marks are shown in the margins.

1. a. Evaluate $\iiint_V \phi \, dV$ where $\phi = x^2 y$ and V denotes the region bounded by the plane $4x + 2y + z = 8$, $x = 0, y = 0, z = 0$. **[5]** **[CO3]**

   b. What do you know about gradient, divergence and curl? Find the directional derivative of the function $\phi(x, y, z) = xy^2 + yz^3$, at the point $(2, -1, 1)$ in the direction of $\hat{i} + 2\hat{j} + 2\hat{k}$. **[5]** **[CO3]**

2. a. Evaluate the integral $\int_1^3 \int_x^{x^2} \int_0^{\ln z} xe^y \, dy \, dz \, dx$. **[5]** **[CO2]**

   b. Use the change of variables $u = x - 2y$, $v = 2x + y$ to evaluate the integral $\iint_R \left(\frac{x - 2y}{2x + y} \right) dx dy$, where R is the region enclosed by the lines $x - 2y = 1$, $x - 2y = 4$, $2x + y = 1$, $2x + y = 3$. **[5]** **[CO2]**

3. a. If the vector field is given by $\hat{F} = (2x - y + z)\hat{i} + (x + y - z^2)\hat{j} + (3x - 2y + 4z)\hat{k}$ then evaluate the line integral over a circular path given by $x^2 + y^2 = a^2$, $z = 0$. **[3]** **[CO3]**

   b. Define arc length and hence find the arc length of the curve $\underline{r}(t) = e^t \cos t \, \underline{i} + e^t \sin t \, \underline{j} + e^t \, \underline{k}$ for $0 \le t \le \frac{\pi}{2}$. **[3]** **[CO2]**

g. Define Jacobian of two variables. $x = \rho\sin\theta\cos\varphi$, $y = \rho\sin\theta\sin\varphi$ and $z = \rho\cos\theta$ then show that $\frac{\partial(x,y,z)}{\partial(\rho,\theta,\varphi)} = \rho^2\sin\theta$. [4] [CO3]

4. a. State Stoke's theorem. Using Stoke's theorem or otherwise evaluate $\oint_C \underline{F}.d\underline{r}$ where $\underline{F} = (x^2+y^2)\hat{i} - 2xy\,\hat{j}$ taken round the rectangle bounded by the lines $x = \pm a$, $y = 0$, $y = b$. [6] [CO5]

b. State Green's theorem for a plane. Using Green's theorem to evaluate $\oint_C [(x-y)^3(dx+dy)]$, where C is the graph of $x^2 + y^2 = a^2$. [4] [CO5]

OR

a. If $\underline{F} = (x^2-y)\hat{i} + (y^2-z)\,\hat{j} + (z^2-x)\hat{k}$ then evaluate the integral $\oint_C \underline{F}.d\underline{r}$ along the path C given by $x = t$, $y = t^2$, $z = t^3$ from $t = 0$ to 1. [3] [CO4]

b. Evaluate the integral $\iint_R e^{xy}dA$, where R is the region enclosed by the lines $y = \frac{1}{2}x$, $y = x$ and the hyperbolas $y = \frac{1}{x}$ and $y = \frac{2}{x}$. [3] [CO3]

c. Evaluate $\iiint_V (\hat{\nabla}\cdot\hat{F})\,dV$ where $\hat{F} = (2x^2-3z)\hat{i} - 2xy\hat{j} - 4x\hat{k}$ and V is the closed region bounded by the planes $x = 0, y = 0, z = 0$ and $2x+2y+z = 4$. [4] [CO5]

5. a. State Gauss's Divergence Theorem. Verify Gauss's Divergence Theorem for $\underline{F} = (x^2-yz)\hat{i} + (y^2-zx)\,\hat{j} + (z^2-xy)\hat{k}$ taken over the rectangular parallelepiped $0 \le x \le a$, $0 \le y \le b$, $0 \le z \le c$. [6] [CO5]

b. Evaluate the integral $\iint_R (x^2+y^2)dA$, where R is the region in the first quadrant bounded by the circle $x^2 + y^2 = a^2$. [4] [CO4]

University of Asia Pacific

Department of Basic Sciences and Humanities

Program: B.Sc. in CSE

Final Examination | **Spring-2023** | **2nd Year 1st Semester**

Course Code: MTH 203 | Course Title: Probability & Statistics | Credit: 3.00

Time: 3.00 Hours | Full Marks: 50

There are **five** questions. **Answer all of them.** Part marks are shown in the margins.

1. a. One bag contains 4 white balls and 3 black balls, and a second bag contains 3 white balls and 5 black balls. One ball is drawn from the first bag and placed unseen in the second bag. What is the probability that a ball now drawn from the second bag is (i) black? (ii) White? **[6] [CO3]**

b. The probability that a regularly scheduled flight departs on time is $P(D) = 0.83$ the probability that it arrives on time is $P(A) = 0.82$ and the probability that it departs and arrives on time is $P(D \cap A) = 0.78$. Find the probability that a plane **[4] [CO3]**

i) arrives on time, given that it departed on time,

ii) departed on time, given that it has arrived on time.

2. a. The probability distribution of X, the number of imperfections per 10 meters of a synthetic fabric in continuous rolls of uniform width, is given by **[5] [CO2]**

x	0	1	2	3	4
$f(x)$	0.41	0.37	0.16	0.05	0.01

Construct the cumulative distribution function of X.

b. The total number of hours, measured in units of 100 hours, that a family runs a vacuum cleaner over a period of one year is a continuous random variable X that has the density function [5] [CO2]

$$f(x) = \begin{cases} x, & 0 \le x < 1 \\ 2 - x, & 1 \le x < 2 \\ 0, & elsewhere \end{cases}$$

Find the probability that over a period of one year, a family runs a vacuum cleaner

i) less than 120 hours,

ii) between 50 and 100 hours.

OR

a. Define expected value E(X) of a random variable X. Let X be a random variable with density function [5] [CO2]

$$f(x) = \begin{cases} \frac{x^2}{3}, -1 < x < 2 \\ 0, \quad elsewhere \end{cases}$$

Find the expected value of $g(x) = 4x + 3$.

b. Suppose that the probabilities are 0.4, 0.3, 0.2, and 0.1, respectively, that 0, 1, 2, or 3 power failures will strike a certain subdivision in any given year. Find the mean and variance of the random variable X representing the number of power failures striking this sub-division. [5] [CO2]

3. a. Show that the mean and variance of the binomial distribution b(x;n,p) are $\mu = np$ and $\sigma^2 = npq$. [6] [CO3]

b. The mean of a binomial distribution is 40 and standard deviation 6. Calculate n, p, q. [4] [CO4]

4. a. A workshop produces 2000 units per day. The average weight of units is 130 kg with standard deviation of 10 kg. Assuming normal distribution, how many units are expected to weigh less than 142 kg? [5] [CO5]

b. The weights of a large number of miniature poodles are approximately normally distributed with a mean of 8 kilograms and a standard deviation of 0.9 kilogram. If measurements are recorded to the nearest tenth of a kilogram, find the fraction of these poodles with weights [5] [CO5]

i) over 9.5 kilograms,

ii) of at most 8.6 kilograms,

iii) between 7.3 and 9.1 kilograms inclusive.

5. a. The mean lifetime of a sample of 100 light tube produced by a company is found to be 1580 hours with standard deviation of 90 hours. Test the hypothesis that the mean lifetime of the tubes produced by the company is 1600 hours. [Use 5 % level of significance] [3] [CO5]

b. You are working as a purchase manager of a company. The following information has been supplied to you by two manufacturers of electric bulbs: [3] [CO4]

	Company A	Company B
Mean life (in hours):	1300	1288
Standard deviation (in hours):	82	93
Sample size:	100	100

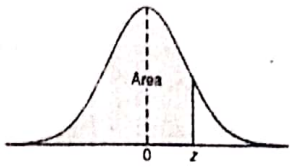
Which brand of bulbs are you going to purchase if your desire is to take a risk of 5%?

c. A researcher wanted to study the relationship between gender and owning cell phones. She took a sample of 2000 adults and obtained the information given in the following table. **[4] [CO5]**

	Own Cell Phones	Do Not Own Cell Phones
Men	74	26
Women	10	30

At the 5% level of significance, can you conclude that gender and owning a cell phone are related for all adults?

Table A.3 Areas under the Normal Curve



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483

Table A.3 (continued) Areas under the Normal Curve

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998