

Rangamati Science and Technology University Department of Computer Science and Engineering

2nd Year 2nd Semester B.Sc. (Engg.) Final Exam-2021

Course Code: CSE-2201; Session: 2019-20

Course Title: Database Management Systems

Marks: 60

Time: 3 Hours

- NB: 1. Answer any **FOUR(4)** questions out of **SIX(6)** questions.
2. Figures in the right margin indicate marks($15 \times 4 = 60$).
3. All parts of a question must be answered serially.

1. (a) Define Data Model. Discuss different types of data models of modern database management system. 5
(b) Briefly explain the ACID properties of DBMS. 4
(c) Differentiate between DDL and DML. Mention few advantages and disadvantages of DBMS 4
(d) Write down the differences between RDBMS and NRDBMS. 2
2. (a) Discuss various types of keys in DBMS with proper example. "In a relation there may exist multiple candidate and primary keys"- justify the statement with rigorous example. 5
(b) Consider the following relational database 6
- employee (person name, street, city)
works (person name, company name, salary)
company (company name, city)

Give an expression in the relational algebra to express each of the following queries:

- i. Find the names of all employees who live in city "Miami".
ii. Find the names of all employees whose salary is greater than \$100,000.
iii. Find the names of all employees who live in "Miami" and whose salary is greater than \$100,000.
- (c) Define schema. Draw a schema diagram for RMSTU student database. 4
3. (a) Define entity set. Explain how you represent complex attributes in ER diagram. 3
(b) Briefly discuss the mapping cardinality constraints with appropriate example. 5
(c) Construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received. 7
4. (a) Define normalization, Describe 1NF, 2NF, and 3NF with suitable example. 4
(b) During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass.
Explain why each state transition may occur. 5

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- (c) Consider the following two transactions:

6

T13: read(A);
read(B);
if A = 0 then B := B + 1;
write(B).

T14: read(B);
read(A);
if B = 0 then A := A + 1;
write(A).

Let the consistency requirement be $A = 0 \vee B = 0$, with $A = B = 0$ the initial values.

- Show that every serial execution involving these two transactions preserves the consistency of the database.
- Show a concurrent execution of T13 and T14 that produces a non-serializable schedule.
- Is there a concurrent execution of T13 and T14 that produces a serializable schedule?

5. (a) Consider the following precedence graph. Is the corresponding schedule conflict serializable? Explain your answer.

6

- (b) Consider the insurance database of the following:

6

Student (snum, sname, major, level, age)

Class (cname, meets-at, room, fid)

Enrolled (snum, cname)

Faculty (fid, fname, deptid)

Construct the following SQL queries for this relational database

- Every class has a maximum enrolled of 30 students.
- At least one class meets in each room.
- Every faculty member must teach at least two courses.

Every student must be enrolled in the course called CSE 101.

- (c) Define the concept of aggregation. Give two examples of where this concept is useful.

3

6. (a) Explain the strong and weak entity set by considering a problem domain in the ER diagram.

4

- (b) Write short notes on the following Extended E-R features:

4

- Specialization
- Decomposition

- (c) Given the following entity sets in a university context:

5

- Faculty
- Teacher
- Course
- Student

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Provide a graphical representation of the relationships and entity sets using E-R diagram. Show the corresponding attributes for each entity set.

- (d) Which factors are basis on the evaluation of Indexing and Hashing Techniques?

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Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 2nd Semester B.Sc. (Engg.) Final Exam-2021

Course Code: CSE-2203; Session: 2019-2020

Course Title: Computer Architecture and Organization

Time: 3 Hours

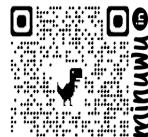
Marks: 60

- NB:
1. Answer any **FOUR (4)** questions out of **SIX (6)** questions.
 2. Figures in the right margin indicate marks($15 \times 4 = 60$).
 3. All parts of a question must be answered serially.

1.
 - (a) Write some differences between computer architecture and computer organization. 3
 - (b) Write the name of the different phases of an instruction cycle and registers involved in an instruction cycle and their functions. 4
 - (c) Describe the operation of 4-bit binary adder. 4
 - (d) Suppose we have a benchmark that executes in 100 seconds of elapsed time, of which 90 seconds is CPU time and the rest is I/O time. The number of processors triples every two years, but the processors remain the same speed, and I/O time doesn't improve. How much faster will our program run at the end of eight years? 4
2.
 - (a) Explain Booth's algorithm. Describe how you can perform multiplication between two signed integers (-3) and (+3) using Booth's algorithm. 4
 - (b) Discuss the block diagram of hardware for addition and subtraction. Explain how you can perform subtraction between two signed integers with proper example. 4
 - (c) There is a Sequence of nine memory references to an empty eight-block cache, including the action for each reference. Show the contents of the cache change on each miss and after handling all misses of address. 5

Decimal Address of Reference	22	26	22	26	16	3	16	18	16
Hit or Miss	Miss	Miss	Hit	Hit	Miss	Miss	Hit	Miss	Hit

3.
 - (a) Describe
 - i) RAID 0
 - ii) RAID 1
 - iii) RAID 10Which RAID level you think best? Rigorously explain. 2
 - (b) Differentiate between SSD and HDD. Which architecture is better and why? 3
 - (c) Briefly discuss different ROM architectures. 3
 - (d) Suppose, address of A=1001, address of B=1010, address of C=1011 and content of A=01, content of B=10. Execute the instruction C=A+B and explain it according to the block diagram of CPU. 5
 4.
 - (a) What do you mean by data dependencies in Pipeline? How to handle data dependencies in software? 3
 - (b) Describe how Finite-state machine controllers are implemented using a block of combinational logic and a register? 5



- (c) Explain the methods of accessing units of data with proper example. 3
- (d) A micro programmed control unit is required to generate a total of 25 control signals. Assume that during any micro instruction, at most two control signals are active. What would be the minimum number of bits required in the control word to generate required control signals? 4
- 5.
- (a) How memory management system supports the multiprogramming in a single processor system? 3
- (b) Write down the differences between static RAM and Dynamic RAM. How the capacitor discharging is prevented in Dynamic RAM? 3
- (c) With a block diagram of a RAM chip, describe the working principle of a RAM chip. 4
- (d) Suppose the miss rate of an instruction cache is 2% and the miss rate of the data cache is 4%. If a processor has a CPI of 2 without any memory stalls and the miss penalty is 100 cycles for all misses, determine how much faster a processor would run with a perfect cache that never missed. Assume the frequency of all loads and stores is 36%. 5
- 6.
- (a) What do you mean by pipelining? How does it help in achieving instruction level parallelism? Explain with rigorous example. 4
- (b) Discuss a scenario for super pipelining and superscalar pipelining respectively. Are there any limitations in each of these categories? If so, how can you overcome such limitations. 4
- (c) Find the average time to read or write a 512-byte sector for a typical disk rotating at 15,000 RPM. The advertised average seek time is 4 ms, the transfer rate is 100MB/sec, and the controller overhead is 0.2 ms. Assume the disk is idle so that there is no waiting time. 4
- (d) Draw the diagram of Microarchitecture of AMD Opteron X4 pipeline. 3



Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 2nd Semester B.Sc. (Engg.) Final Exam-2021

Course Code: CSE-2204; Session: 2019-2020

Course Title: Design and Analysis of Algorithms

Time: 3 Hours

Marks: 60

- NB:
1. Answer any **FOUR (4)** questions out of **SIX (6)** questions.
 2. Figures in the right margin indicate marks ($15 \times 4 = 60$).
 3. All parts of a question must be answered serially.

1. (a) Define algorithms. How do learning algorithms make you a better programmer? 3

(b) With the help of a neat flow diagram, explain the Algorithm design and analysis process. Discuss the various stages of the algorithm design and analysis process using a flow chart. 3

(c) What do you mean by time and space complexity of an algorithm? Explain time-space trade-off concept. 3

(d) Suppose you have to choose among three algorithms to solve a problem:
 - Algorithm A solves an instance of size n by recursively solving eight instances of size $n=2$, and then combining their solutions in time $O(n^3)$.
 - Algorithm B solves an instance of size n by recursively solving twenty instances of size $n=3$, and then combining their solutions in time $O(n^2)$.
 - Algorithm C solves an instance of size n by recursively solving two instances of size $2n$, and then combining their solutions in time $O(n)$.Which one is preferable, and why? 6
2. (a) Describe every steps to divide the following list of numbers into two sub list using the process used in Quick sort algorithm: 4
41, 79, 65, 35, 21, 48, 59, 87, 52, 28

(b) Which searching algorithm you will be using in each of the following scenarios? Please explain your choice (in no more than 3 lines per scenario). 4
i) You have an array of 1 million integers sorted in ascending order. You want to find an integer from this array – let's call this operation a query. There is only a single query in this scenario.
ii) Now, you have the same array of 1 million integers but this time they are in descending order. Again, there will only be a single query.
iii) For the third scenario, the numbers are no longer sorted. Again, there will be a single query only.
iv) For the final scenario, the numbers are not sorted just as in scenario (iii). But this time there will be 10000 different queries.

(c) Explain, in general terms, the main differences between the divide-and-conquer technique and dynamic programming 4

(d) What do you mean by analysis of algorithm? Describe the three asymptotic notations of an algorithm. 3
3. (a) What is in place sorting algorithm? Apply **merge sort** for the following list. Draw all necessary steps until the list is sorted. 4
 $A = \{18, 26, 32, 6, 43, 15, 9, 1, 22, 26, 19, 55, 37, 43\}$

(b) What is the best way to multiply a chain of matrices with dimensions that are $10 \times 5, 5 \times 2, 2 \times 10, 10 \times 12$ using dynamic programming? 4



- (c) Trace the dynamic programming algorithm for the longest common subsequence problem with strings $X[1\dots 4] = \text{"bach"}$ and $Y[1\dots 6] = \text{"abcabc"}$. Complete all the entries in the table below, and also build all of the optimal solutions.

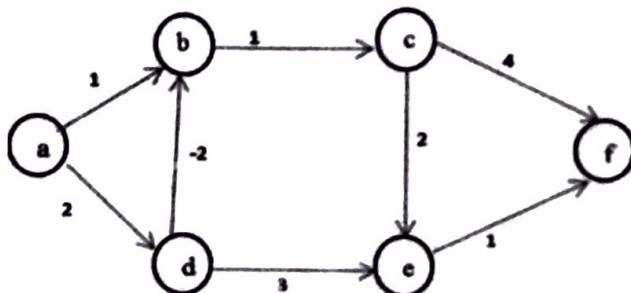
	0	1	2	3	4	5	6
0							
1							b
2						a	
3					c		
4				b			
	a	b	c	a	b	c	

5

- (d) What makes a good hash function? Give example.

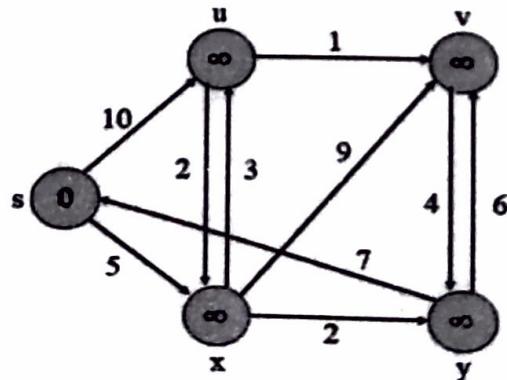
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4. (a) Consider the following graph. Show the minimum cost to travel from node A to node F using Bellman-Ford Algorithm.



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- (b) Define single source shortest path. Find the shortest path for the following graph in figure: 4(b) using Dijkstra's algorithm.



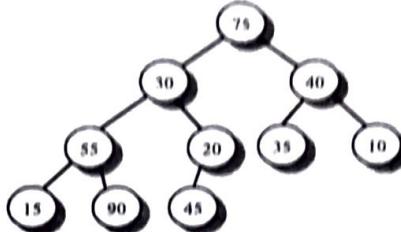
5

- (c) Write Warshall's algorithm and apply it to compute transitive closure for the directed graph with the adjacency matrix shown below:

5

	A	B	C	D
A	0	1	0	0
B	0	0	0	1
C	0	0	0	0
D	1	0	1	0

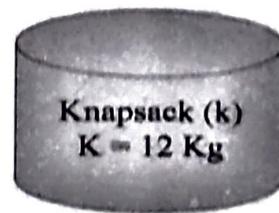
5. (a) What is N-Queens Problem? Give a solution to the N-Queens Problem using the Backtracking method. 5
- (b) State your opinion on "All Pairs Shortest Path Algorithm". 3
- (c) What do you mean by class P and class NP? 4
- (d) Start with the following tree and use the Heapify algorithm to convert it into a maximum heap. Draw the resulting tree. 3



6. (a) Explain the knapsack problem. Apply the algorithm to determine the population of second generation on the following Knapsack. Consider initial population as four random chromosomes each of 4 bits. 5

Gene: 0 → absence of item in the knapsack
and 1 → presence of item in the knapsack

Item	Weight	Value
A	5Kg	\$12
B	3Kg	\$5
C	7Kg	\$10
D	2Kg	\$7



- (b) Write down the Quick-Hull algorithm to find a CONVEX HULL in a geometric plane and test it using suitable data. 5
- (c) The Longest Increasing Subsequence (LIS) problem is to find the length of the longest subsequence of a given sequence such that all elements of the subsequence are sorted in non-decreasing order. That is, it should be in increasing order, but you can have equal elements as well. Now you have to find the length of the longest subsequence of a given sequence. 5

Constraints:

$1 \leq T \leq 20$

$1 \leq N \leq 100$

$-10^9 \leq A[i] \leq 10^9$ where $A[i]$ is the array element.

1

9

10 22 9 33 21 50 41 60 80



RANGAMATI SCIENCE AND TECHNOLOGY UNIVERSITY

Department of Computer Science and Engineering

2nd Year 2nd Semester BSc (Engineering) Final Examination-2021

Session: 2019–2020

Course: Design and Analysis of Algorithms Lab; Code: CSE 2205

Full Marks: 40

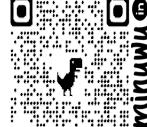
Duration: 01 Hour;

[Answer any TWO algorithms from the following. The figures in the right margin indicate full marks]

<u>Q. No.</u>	<u>Marks</u>
1. Linear Search Algorithm	20
2. Binary Search Algorithm	20
3. Bubble Sort Algorithm	20
4. Insertion Sort Algorithm	20
5. Selection Sort Algorithm	20



Rangamati Science and Technology University
Department of Computer Science and Engineering
2nd Year 2nd Semester B.Sc. (Engg.) Final Exam- 2021



Course Title: Microprocessor and Assembly Languages, **CourseCode:** CSE-2206

Time: 3 Hours

Full Marks: 60

Answer any 4 (four) Questions
(Figure in the right hand margin indicates marks)

1. (a) Briefly describe about the block diagram of a typical computer system. 4
(b) An assembly language program and a memory map are given in figure – 1 (b). Assume, stack segment = 2000H and stack position (initial) = 110FH.

MOV AX, 1122H
MOV BX, 2233H
MOV DX, 3344H
MOV SP, 4455H
MOV SI, 5566H
MOV CX, 6677H
MOV DI, 7788H
MOV BP, 6767H
PUSH A
PUSH WORD PTR [2002H]
POP F
POP WORD PTR [2005H]
POP AX
POP CX
POP SP

DS	
FF	2000H
SS	2001H
BB	2002H
66	2003H
59	2004H
CC	2005H
99	2006H
10	2007H
EE	2008H
ED	2009H
22	200AH

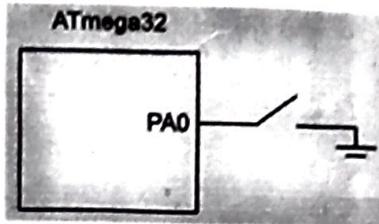
Figure – 1 (b)

At the end of the execution of the above program determine:

- i) Physical address
ii) The final value of all the registers
iii) Draw DS and SS memory map
- (c) Write down the programming model of 8086 microprocessor. 5
2. (a) What are the significance segments registers in the operation of the microprocessor? 2
(b) Define address decoding? Discuss the operation of 3-to-8 line decoder. 5
(c) Given that, DX = 1100B, BX = 0200H, LIST = 0250D and SI = 0500H. Determine the consequences of following instructions:
i) MOV LIST [SI], DX
ii) MOV CL, LIST [BX+SI]
iii) MOV CH, [BX+SI]
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- (d) Briefly explain various roles of "Flag Bits" in 8086 microprocessors with necessary examples. 4
3. (a) Define interrupt, interrupt vector and interrupt handler. Why T and I Flag bit should be cleared in case of software interrupt? 5
(b) Discuss the following topics with suitable example-
1. Base-plus-index addressing
2. Register indirect addressing
3. Double-precision shifts 6



- | | | |
|--------|--|---|
| (c) | Explain the operation of various types of ROTATE instruction with suitable diagram. | 4 |
| 4. (a) | Explain the operation of stack memory addressing mode in details. | 5 |
| (b) | Briefly explain SRAM and DRAM. | 4 |
| (c) | With the neat sketch of timing diagram, explain the read and write bus cycle of 8086 MPU showing all control signals. | 6 |
| 5. (a) | Write down the assembly code to declare Data segment in a procedure? Explain it. | 3 |
| (b) | Write two differences between CISC and RISC. Which one of them is used in ATmega32? | 3 |
| (c) | A switch is connected to an ATmega32 in figure – 5 (c).
i) What is the problem with such a connection?
ii) How can you solve the problem without modifying the connection? | 4 |



- (d) Discuss about various types of memory model declaration in assembly code. Is the following code correct? If not correct it-
- 2+3
- MSG DB 'Hello World', '\$'

LEA DX, MSG
MOV AH, 2

INT 20H

6. (a) Draw a ladder logic diagram to control the motor output as per the given logic in figure – 6
(b) Make use of start and stop pushbuttons, 4 switches to turn on and off 2 motors (M) and a buzzer (B).

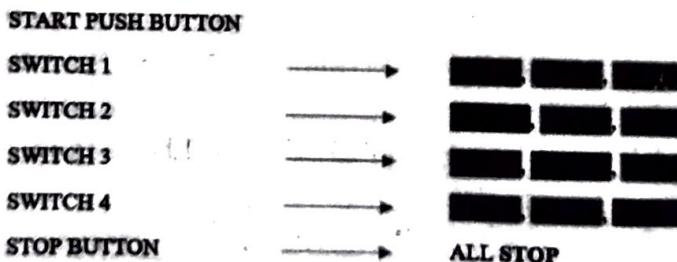
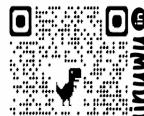


Figure – 6 (b)

- (b) What is bus timing? Briefly explain 8086 write bus cycle.
(c) What do you mean by maximum and minimum mode of operation?
(d) Discuss the following topics-

1. DEN
2. INTR
3. READY
4. ALE

1+3
2
4



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Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 2nd Semester P.Sc. (Engg.) Final Exam- 2021

Course Title: Microprocessor and Assembly Languages Lab, Course Code: CSE-2207

Full Marks: 60

Time: 3 Hours

- NB:
1. Answer any SIX (6) questions.
 2. Figures in the right margin indicate marks.
 3. Parts of same question must be answered serially.

1. Write an assembly program that place two character in orderly form. 10
2. Write an assembly program that shows uppercase to lowercase conversion. 10
3. Write an assembly program that shows sum of two digits (less than 10). 10
4. Write an assembly program that shows three digits displayed down the left margin as left, middle and last initials. 10
5. Write an assembly program that read the hex digit and shows in decimal format. 10
6. Write an assembly program that multiply two decimal numbers. 10
7. Write an assembly program that display a “Hello” string for 10 times in next line. 10



Rangamati Science and Technology University

Department of Computer Science and Engineering

2nd Year 2nd Semester B.Sc. (Engg.) Final Exam-2021

Course Code: CSE-2209; Session: 20119-2020

Course Title: Probability and Statistical Analysis

Time: 3 Hours

Marks: 60

- NB:
1. Answer any **FOUR(4)** questions out of **SIX(6)** questions.
 2. Figures in the right margin indicate marks($15 \times 4 = 60$).
 3. All parts of a question must be answered serially.

1. (a) Define a Poisson distribution. Under what conditions it tends to the normal distribution? 4
Cite some practical examples of Poisson distributions.
- (b) Given $\lambda = 4.2$, for a Poisson distribution, find (i) $P[X \leq 2]$; (ii) $P[X \geq 5]$; and 4
(iii) $P[X = 8]$
- (c) A random variable has the following probability function 7

Values of X:x	-2	-1	0	1	2
P(x)	0.1	k	0.2	0.1	0.3

(i) Find the value of k; (ii) $P[X > 1]$; (iii) $P[-1 < X < 2]$; (iv) $P[X < 1]$;
(v) $P[1 \leq X < 3]$; (vi) Also calculate the mean and coefficient of variation of random variable X.

2. (a) Define normal distribution. Write down some properties of normal distribution. 3
- (b) Suppose X is a normal variable with a mean of 8 and a variance of 4. Write the distribution form of normal distribution. Also find (i) $P[X \geq 12]$; (ii) $P[0 < X < 8]$ and 5
 $P[X = 13]$
- (c) Define probability density function. A continuous random variable has the following 7
density function $f(x) = kx^2$, $0 \leq x \leq 1$. (i) Find the value of k;
(ii) $P[0.2 \leq X \leq 0.5]$; (iii) $P[X < 0.3]$; $P[0.25 < X < 0.5]$ and $P[X > 0.75]$.
3. (a) Define variable. Write down the different types of variables with examples. Distinguish 5
between discrete and continuous variables.
- (b) The following data refer to the ages of 30 employees of a firm- 10
33, 41, 21, 25, 36, 38, 35, 36, 35, 37, 42, 30, 35, 37, 36, 38, 30, 54, 40, 48, 15, 28, 51, 42,
25, 41, 30, 27, 42, 36.

- Construct a frequency table with a suitable class interval.
- Find cumulative, relative and percent of frequency of the age of the workers and comment.
- Draw a histogram and frequency curve from the frequency table
- What conclusion do you draw from the frequency distribution table?

4. (a) Define central tendency. What are the important measures of central tendency? Which 4
one is best and why?
- (b) The lengths of service (in years) of the Chief Justice of the Supreme Court are 7, 1, 5, 35, 4
28, 10, 15, 22, 11, 10, 12, 6, 8, 14, 18, 16
Find **mean, median, mode, range and 3rd quartile**.

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- (c) Given the following frequency distribution of time requirement of students for completing an experiment in a laboratory: 7

Time (in minutes)	40-60	60-80	80-100	100-120	120-140	140-160	160-180
No. of Students	3	15	16	20	18	10	8

Calculate the mean, median, mode, and 3rd quartile of the above distribution

5. (a) Define standard deviation and coefficient of variation. Why sometimes the coefficient of variation is better than the standard deviation as a measure of dispersion? 4

- (b) The following data refer to the marks obtained by 15 students in a class test: 5

9, 4, 6, 11, 8, 9, 11, 9, 10, 8, 7, 7, 5, 7, and 10.

Find (i) Quartile deviation; (ii) standard deviation; (iii) Coefficient of variation

- (c) The lives of two models of computer in a recent survey are given below: 6

Life in Year	IBM	ASUS
0-2	5	2
2-4	13	7
4-6	20	12
6-8	7	20
8-10	5	9

- i) Which model has more average life?
ii) Which model has greater variation in life?
iii) A person wants to buy a computer, which one he/she will prefer and why?

6. (a) Short notes: 10-8

- a. Parameter vs. statistic
b. An outcome vs. an event

- (c) Define correlation coefficient. The following sample observations were randomly selected- 6-7

X	5	3	6	3	4	4	6	8
Y	13	15	7	12	13	11	9	5

Determine the coefficient of correlation and interpret the association between X and Y.