

GANPAT UNIVERSITY**B. TECH.CSE (CBA/CS/BDA) SEM- IV REGULAR/REMEDIAL EXAMINATION****APRIL-JUNE 2022****(2CSE403) FUNCTIONAL PROGRAMMING****TIME: 3 HRS****TOTAL MARKS: 60****SECTION - I**

- Q-1** (1) Which function is used to check an object belongs to a particular class? [01]
- (2) Differentiate ** and // Operator in python. [01]
- (3) Only _____ objects can be a part of a set object. [01]
- (4) Write down the usage of keyword arguments in function with proper code. [01]
- (5) Define Anonymous function. [01]
- (6) Predict the output:
`fr k in range(10):
 print(k)` [01]
- (7) The expression a{5} will match _____ characters with the previous regular expression. [01]
- (8) Write syntax for to open a file c:\scores.txt for appending data. [01]
- (9) List out various request methods in http protocol. [01]
- (10) What will be the output of the following Python code? [01]
`sentence = 'we are humans'
 matched = re.match(r'(.*) (.*) (.*)', sentence)
 print(matched.group())`
- Q-2** (A) i) Make a program in Python to filter odd and even number from a list. [02]
 Given [2, 23, 24, 51, 46, 67]
 Expected output
 Even [2, 24, 46] Odd [23, 51, 67]
- ii) Design a Python program to display a bar chart of the popularity of programming Languages [03]
 Programming languages: Java, Python, PHP, JavaScript, C#, C++
 Popularity: 23.2, 17.4, 6.8, 8, 7.4, 5.9
- Q-2** (B) i) Complete the code and write appropriate output: [02]
`class Employee:
 def add(self, a, b):
 print('The Sum of Two = ', ??)
 class Department(Employee):
 def add(self, a, b, c):
 print('The Sum of Three = ', ???)
 ???`

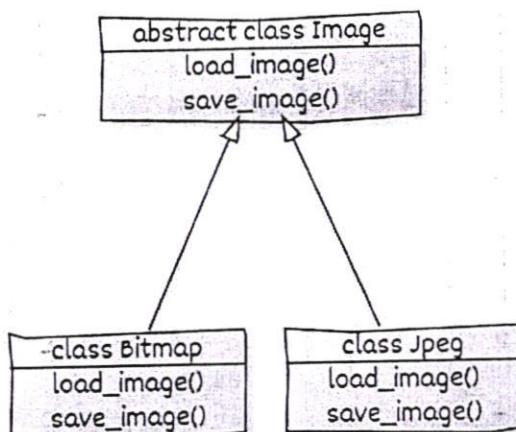
- ii) Sanju wants to create a python program which takes a number from user and if entered number is not in range between 101 to 200 it should generate a ValueError exception. Help him and handle the exception with suitable python code.

OR

- Q-2 (B)** Nancy wants to design a program to display the smallest word from the user entered string. Help her with suitable python code. [05]

- Q-3** Attempt ANY TWO from the following: [10]

(A)



By making appropriate python program try to implement given figure via OOP terminology. Note down that `load_image()` of an `Image` class is protected.

- (B)** Create a Table called Salesmen via python code with columns like id, name, city, commission. Perform following operations on created table via python:

- Insert 4 records in the table
- Update any one record
- Display all records

Assume Data source for above code is MySql.

- (C)** 1. Extract the user id, domain name and suffix from the following email addresses via RE.

`emails = """zuck26@facebook.com`

`page33@google.com`

`jeff42@amazon.com"""`

`desired_output = [('zuck26', 'facebook', 'com'), ('page33', 'google', 'com'), ('jeff42', 'amazon', 'com')]`

2. Remove all hashtags, punctuations, RTs and CCs using RE.

`tweet = "Good advice! RT: What I would do differently if I was learning to code today cc: #rstats"`

SECTION - II

- Q-4 (1)** What error is returned by the following statement if the file does not exist? [01]

`f=open("A.txt")`

- (2)** Differentiate List and Tuple. [01]

- (3)** What is the output of given code snippet? [01]

`list2 = [1,4,6,4,7,8,2,3]`

`print(list2[-1])`

- (4)** Seema wants to rise her own exception called `seemaException`. Help her with suitable syntax. [01]

- (5)** How many times are the following loops executed? [01]

`i=100`

`while(i<=200):`

`print i`

`i+=20`

- (6) Find the output: [01]
 def hello():
 try:
 return 1
 finally:
 return 2
 print(hello())
- (7) Differentiate search() and findall() in python. [01]
- (8) What is the output of given code snippet? [01]
- ```
n=20
for i in range(2,n//4):
 if n%i==0:
 print("Python Output based Questions")
 else:
 print("Bye")
```
- (9) What is the output of the following code ? [01]
- ```
try:
    if '2' != 2:
        raise ValueError
    else:
        print('same')
except ValueError:
    print('ValueError')
except NameError:
    print('NameError')
```
- (10) While object creation _____ method called first before __int__0 via python interpreter. [01]

- Q-5 (A)** An automobile company wants a program to accept the cost price of a bike from user and [05] display the road tax to be paid according to the following criteria:

| Cost price (in Rs) | Tax |
|-----------------------|------|
| > 100000 | 15 % |
| > 50000 and <= 100000 | 10% |
| <= 50000 | 5% |

- Q-5 (B)** Sheela is making a python program in which a function "perfect()" that determines if [05] parameter number is a perfect number. Use this function in her program that determines and prints all the perfect numbers between 1 and 1000.
 [An integer number is said to be "perfect number" if its factors, including 1 (but not the number itself), sum to the number. E.g., 6 is a perfect number because $6=1+2+3$].

OR

- Q-5 (B)** i) Design a Python program to remove the intersection of a 2nd set from the 1st set. [02]

- ii) Kunal wants to create a Python program to convert a given list of tuples to a list of lists. [03]

Sample output:

Original list of tuples:

`[(1, 2), (2, 3), (3, 4)]`

Convert the said list of tuples to a list of lists:

`[[1, 2], [2, 3], [3, 4]]`

- Q-6** Attempt ANY TWO from the following: [10]

- (A) Anju wants to design a python program which randomly generate array of rank 2 and shape (5,4). All elements of array should be in the range of (1,10). Return an array of odd rows and even columns from generated array. Help him with suitable code.

- (B) Create a class, Triangle. Its `__init__()` method should take self, angle1, angle2, and angle3 as arguments.

Create a variable named `number_of_sides` and set it equal to 3,

Create a method named `check_angles`. The sum of a triangle's three angles is It should return True if the sum of self. angle1, self. angle2, and self. angle3 is equal 180, and False otherwise,Also, create a child class of triangle called Equilateral if any one angle is 60 then print it is Equilateral otherwise not.

- (C) Design a python code that accept input from the user and display the occurrence of that specific word from a text file.

Input:

Enter the word to count: Learn

Expected Output:

Result is: 2

Demo.txt:

Hi everyone, I hope you are doing good.

Welcome to Python World!!!!

Learn by Learn

Machine Learning

Data Analysis

~: END OF PAPER :~

GANPAT UNIVERSITY
B. TECH.CSE (CBA/CS/BDA) SEM- IV REGULAR EXAMINATION APRIL-JUNE 2022
(2CSE403) FUNCTIONAL PROGRAMMING
Solution**TOTAL MARKS: 60****TIME: 3 HRS****SECTION - I**

- Q-1** (1) Which function is used to check an object belongs to a particular class? [01]
 A: `isinstance()`
- (2) Differentiate `**` and `//` Operator in python. [01]
 A: `**` (Exponent) It is an exponent operator represented as it calculates the first operand power to the second operand.
`//` (Floor division) It gives the floor value of the quotient produced by dividing the two operands.
- (3) Only _____ objects can be a part of a set object. [01]
 A: immutable (and hashable)
- (4) Write down the usage of keyword arguments in function with proper code. [01]
 A:
`def printinfo(name, age):`
 "This prints a passed info into this function"
 print "Name: ", name
 print "Age ", age
 return;
 # Now you can call printinfo function
`printinfo(age=50, name="miki")`
- (5) Define Anonymous function. [01]
 - A: These functions are called anonymous because they are not declared in the standard manner by using the `def` keyword.
 - You can use the `lambda` keyword to create small anonymous functions.
- (6) Predict the output: [01]
`for k in range(10):`
 `print(k)`
 A: Output:
 File "ErrorsAndExceptions.py", line 4
`for k in range(10):`
 `^`
`SyntaxError: invalid syntax`
- (7) The expression `a{5}` will match _____ characters with the previous regular expression. [01]
 A: exactly 5
- (8) Write syntax for to open a file `c:\scores.txt` for appending data. [01]
 A: `outfile = open("c:\\scores.txt", "a")`
- (9) List out various request methods in http protocol. [01]
 A: GET,POST,HEAD,PUT,DELETE,TRACE
- (10) What will be the output of the following Python code? [01]
`sentence = 'we are humans'`
`matched = re.match(r'(.*) (.*) (.*)', sentence)`
`print(matched.group())`

A: 'we are humans'

- Q-2 (A) i)** Make a program in Python to filter odd and even number from a list. [02]
 Given [2, 23, 24, 51, 46, 67]
 Expected output
 Even [2, 24, 46] Odd [23, 51, 67]

A: num = [2, 23, 24, 51, 46, 67]

even = []

odd = []

```
for i in range(len(num)):
    if num[i] % 2 == 0:
        even.append(num[i])
    else:
        odd.append(num[i])

print("Even elements are", even)
print("Odd elements are", odd)
```

- ii)** Design a Python program to display a bar chart of the popularity of programming Languages. [03]

Programming languages: Java, Python, PHP, JavaScript, C#, C++

Popularity: 23.2, 17.4, 6.8, 8, 7.4, 5.9

A:

```
import matplotlib.pyplot as plt
x = ['Java', 'Python', 'PHP', 'JavaScript', 'C#', 'C++']
popularity = [22.2, 17.6, 8.8, 8, 7.7, 6.7]
x_pos = [i for i, _ in enumerate(x)]

plt.bar(x_pos, popularity, color=(0.4, 0.6, 0.8, 1.0))

plt.xlabel("Languages")
plt.ylabel("Popularity")
plt.title("PopularitY of Programming Language\n" + "Worldwide, Oct 2017 compared to a
year ago")
plt.show()
```

- Q-2 (B) i)** Complete the code and write complete code with output: [02]

class Employee:

```
def add(self, a, b):
    print('The Sum of Two = ', ?? )
```

class Department(Employee):

```
def add(self, a, b, c):
    print('The Sum of Three = ', ??? )
???
```

A: class Employee:

```

def add(self, a, b):
    print('The Sum of Two = ', a + b)

class Department(Employee):

    def add(self, a, b, c):
        print('The Sum of Three = ', a + b + c)

emp = Employee()
emp.add(10, 20)

dept = Department()
dept.add(50, 130, 90)

```

[03]

- ii)** Sanju wants to create a python program which takes a number from user and if entered number is not in range between 101 to 200 it should generate a ValueError exception. Help him and handle the exception with suitable python code.

A:

```

try:
    x=int(input('Enter a number between 101-200: '))
    if x < 100 && x>200:
        raise ValueError(x)
except ValueError:
    print(x, "is out of allowed range")
else:
    print(x, "is within the allowed range")

```

OR

- Q-2 (B)** Nancy wants to design a program to display the smallest word from the user entered string. Help her with suitable python program.

[05]

A:

```

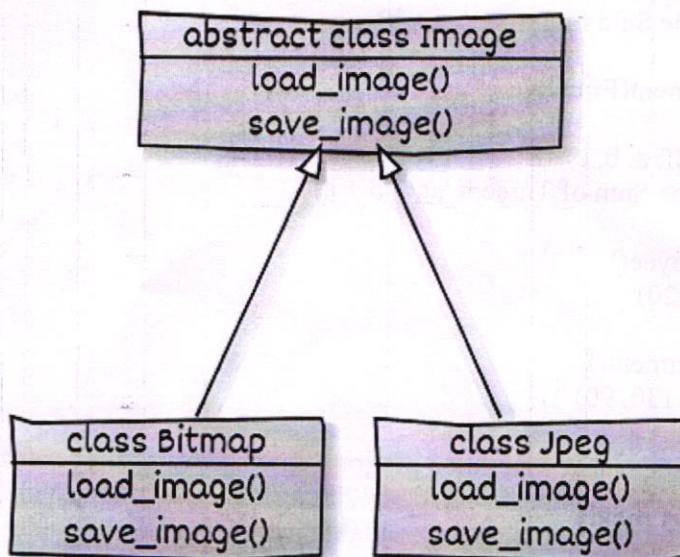
str=input("Enter any String :")
L = str.split()
min=50 #we think that length of any word in the string is not larger than 50 (can give any other number)
b=""
for i in L:
    if len(i) < min:
        b=i
        min=len(i)
print("Smallest word is : ",b)

```

- Q-3** Attempt ANY TWO from the following:

[10]

(A)



By making appropriate python program try to implement given figure via OOP terminology.
Note down that `load_image()` of an `Image` class is protected.

A:

```

from abc import ABC, abstractmethod
#Abstract Class
class Image(ABC):
    @abstractmethod
    def _load_image(self):
        pass
    @abstractmethod
    def save_image(self):
        pass
#Sub class/ child class of abstract class
class Bitmap(Image):
    def _load_image(self):
        print("load image of bitmap")
    def save_image(self):
        print("save image of bitmap")

class Jpeg(Image):
    def _load_image(self):
        print("load image of jpeg")
    def save_image(self):
        print("save image of jpeg")

s= Bitmap()
s.load_image()
s.save_image()

s1= Jpeg()
s1.load_image()
s1.save_image()
  
```

- (B) Create a Table called Salesmen via python code with columns like id,name,city,commission.
Perform following operations on created table via python:

i) Insert 4 records in the table

ii) Update any one record

iii) Display all records

Assume Data source for above code is MySql.

A:

```
import sqlite3

from sqlite3 import Error

def sql_connection():
    try:
        conn = sqlite3.connect('mydatabase.db')
    return conn
    except Error:
        print(Error)

def sql_table(conn):
    cursorObj = conn.cursor()
    # Create the table
    cursorObj.execute("CREATE TABLE salesman(salesman_id n(5), name char(30), city
    char(35), commission decimal(7,2));")
    # Insert records
    cursorObj.executescript("""
        INSERT INTO salesman VALUES(5001,'James Hoog', 'New York', 0.15);
        INSERT INTO salesman VALUES(5002,'Nail Knite', 'Paris', 0.25);
        INSERT INTO salesman VALUES(5003,'Pit Alex', 'London', 0.15);
        INSERT INTO salesman VALUES(5004,'Mc Lyon', 'Paris', 0.35);
    """)
    conn.commit()
    cursorObj.execute("SELECT * FROM salesman")
    rows = cursorObj.fetchall()
    print("Agent details:")
    for row in rows:
        print(row)
    sqllite_conn = sql_connection()
    sql_table(sqllite_conn)
    if (sqllite_conn):
        sqllite_conn.close()
```

- (C) 1. Extract the user id, domain name and suffix from the following email addresses via RE.

emails = "zuck26@facebook.com

page33@google.com

jeff42@amazon.com"

desired_output = [('zuck26', 'facebook', 'com'), ('page33', 'google', 'com'), ('jeff42', 'amazon', 'com')]

2. Remove all hashtags, punctuations, RTs and CCs using RE.

tweet = "Good advice! RT: What I would do differently if I was learning to code today cc: #rstats"

A:

1. pattern = r'(\w+)@([A-Z0-9]+)\.([A-Z]{2,4})'
re.findall(pattern, emails, flags=re.IGNORECASE)

2. import re

```
def clean_tweet(tweet):
    tweet = re.sub('RT|cc', '', tweet) # remove RT and cc
    tweet = re.sub('#\$+', '', tweet) # remove hashtags
    tweet = re.sub('[%s]' % re.escape("""!"#$%&'()*+,-./;=>?@[\]^`{|}~"""), '', tweet) # remove punctuations
    tweet = re.sub("\s+", ' ', tweet) # remove extra whitespace
    return tweet
print(clean_tweet(tweet))
```

SECTION - II

- Q-4** (1) What error is returned by the following statement if the file does not exist? [01]
`f=open("A.txt")`
 A: FileNotFoundError
- (2) Differentiate List and Tuple. [01]
 A: **Ordered** Sequence of objects, will be represented with **square brackets []**
Ordered immutable sequence of objects, will be represented with **round brackets ()**
- (3) What is the output of given code snippet? [01]
`list2 = [1,4,6,4,7,8,2,3]`
`print(list2[-1])`
 A: 3
- (4) Seema wants to rise her own exception called seemaException. Help her with suitable syntax. [01]
 A:
`raise seemaException("This is seema custom exception")`
- (5) How many times are the following loops executed? [01]
`i=100`
`while(i<=200):`
 `print i`
 `i+=20`
 A:6
- (6) Find the output: [01]
`def hello():`
 `try:`
 `return 1`
 `finally:`
 `return 2`
`print(hello())`
 A: 2
- (7) Differentiate search() and findall() in python. [01]
 A: findall() module is used to search for “all” occurrences that match a given pattern while The re.search() method limit us to find matches at the beginning of the string only.
- (8) What is the output of given code snippet? [01]
`n=20`
`for i in range(2,n//4):`
 `if n%i==0:`
 `print("Python Output based Questions")`
 `else:`
 `print("Bye")`

A: Python Output based Questions

Bye

Python Output based Questions

- (9) What is the output of the following code ?

[01]

try:

```
    if '2' != 2:
        raise ValueError
```

else:

```
    print('same')
```

except ValueError:

```
    print('ValueError')
```

except NameError:

```
    print('NameError')
```

A: ValueError

- (10) While object creation _____ method called first before __int__() via python interpreter.

[01]

A: __new__()

- Q-5 (A) An automobile company wants a program to accept the cost price of a bike from user and display the road tax to be paid according to the following criteria:

| Cost price (in Rs) | Tax |
|-----------------------|------|
| > 100000 | 15 % |
| > 50000 and <= 100000 | 10% |
| <= 50000 | 5% |

A: tax = 0

```
pr=int(input("Enter the price of bike"))
```

if pr > 100000:

```
    tax = 15/100*pr
```

elif pr >50000 and pr <=100000:

```
    tax = 10/100*pr
```

else:

```
    tax = 5/100*pr
```

```
print("Tax to be paid ",tax)
```

- Q-5 (B) Sheela is making a python program in which a function "perfect()" that determines if parameter number is a perfect number. Use this function in her program that determines and prints all the perfect numbers between 1 and 1000.

[An integer number is said to be "perfect number" if its factors, including 1 (but not the number itself), sum to the number. E.g., 6 is a perfect number because $6=1+2+3$].

A:

```
def perfect(n):
```

```
    sum = 0
```

```
    for i in range(1,n): if n%i == 0:
```

```
        sum = sum + i
```

```
    if sum == n:
```

```
        return True
```

```
    else:
```

```
        return False
```

```
for i in range(1,1001):
```

```
    if perfect(i):
```

```
        print i
```

OR

- Q-5 (B) i)** Design a Python program to remove the intersection of a 2nd set from the 1st set.
- A:
- ```

sn1 = {1,2,3,4,5}
sn2 = {4,5,6,7,8}
print("Original sets:")
print(sn1)
print(sn2)
print("\nRemove the intersection of a 2nd set from the 1st set using difference_update():")
sn1.difference_update(sn2)
print("sn1: ",sn1)
print("sn2: ",sn2)
sn1 = {1,2,3,4,5}
sn2 = {4,5,6,7,8}
print("\nRemove the intersection of a 2nd set from the 1st set using -= operator:")
sn1-=sn2
print("sn1: ",sn1)
print("sn2: ",sn2)

```

[03]

- ii)** Kunal want to create a Python program to convert a given list of tuples to a list of lists.
- Sample output:

Original list of tuples:

[(1, 2), (2, 3), (3, 4)]

Convert the said list of tuples to a list of lists:

[[1, 2], [2, 3], [3, 4]]

A:

```

def test(lst_tuples):
 result = [list(el) for el in lst_tuples]
 return result
lst_tuples = [(1,2), (2,3), (3,4)]
print("Original list of tuples:")
print(lst_tuples)
print("Convert the said list of tuples to a list of lists:")
print(test(lst_tuples))

```

- Q-6** Attempt ANY TWO from the following:

[10]

- (A)** Anju wants to design a python program which randomly generate array of rank 2 and shape (5,4). All elements of array should be in the range of (1,10). Return an array of odd rows and even columns from generated array. Help him with suitable code.

A:

```

import numpy as np
E=np.random.randint(1,9,(5,4))
print("Printing Input Array")
print(E)
print("\n Printing array of odd rows and even columns")
newArray = E[::2, 1::2]
print(newArray)

```

- (B)** Create a class, Triangle. Its `__init__()` method should take self, angle1, angle2, and angle3 as arguments.

Create a variable named `number_of_sides` and set it equal to 3,

Create a method named `check_angles`. The sum of a triangle's three angles is It should return True if the sum of self. angle1, self. angle2, and self. angle3 is equal 180, and False otherwise,Also, create a child class of triangle called Equilateral if any one angle is 60 then print it is Equilateral otherwise not.

```

A: class Triangle(object):
... def __init__(self,angle1,angle2,angle3):
... self.angle1=angle1
... self.angle2=angle2
... self.angle3=angle3
...
... number_of_sides=3
... def check_angles(self):
... if self.angle1+self.angle2+self.angle3 ==180:
... return True
... else:
... return False
...
>>> class Equilateral(Triangle):
... angle = 60
... def __init__(self):
... self.angle1 = self.angle2 = self.angle3 = self.angle
...
>>> my_triangle=Triangle(90,30,60)
>>>
>>> print my_triangle.number_of_sides
3
>>> print my_triangle.check_angles()
True

```

- (C) Design a python code that accept input from the user and display the occurrence of that specific word from a text file.

Input:

Enter the word to count: Learn

Expected Output:

Result is: 2

**Demo.txt:**

Hi everyone, I hope you are doing good.

Welcome to Python World!!!!

Learn by Learn

Machine Learning

Data Analysis

```

A: def read_data():
x = input("Enter the word you wan to count")
f = open("demo.txt",'r')
s = f.read()
s = s.split()
count = 0
for i in range(len(s)):
if s[i] == x:
count = count+1
else:
pass
print(count)
read_data()

```

~: END OF PAPER :~

**GANPAT UNIVERSITY**  
**B. TECH. CSE SEM- IV(CBA/BDA/CS)**  
**CBCS REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2022**  
**2CSE402 OPERATING SYSTEM**

**MAX. TIME: 3 HRS****TOTAL MARKS: 60**

- Instructions:** (1) This Question paper has two sections. Attempt each section in separate answer book.  
(2) Figures on right indicate marks.  
(3) Assume suitable data if necessary.  
(4) Standard terms and notation are used.

**SECTION - I**

- Q-1 (1) List out any two characteristics of LINUX Kernel. [01]  
(2) Why interrupts are essentials for any OS? [01]  
(3) Can we get list of processes under execution by CPU in Linux? How? [01]  
(4) List out any one privilege Instruction that make CPU to enter into kernel mode. [01]  
(5) During process scheduling, why NEW QUEUE is maintained by OS? [01]  
(6) Which master process take care of re-parenting of orphan processes in LINUX? [01]  
(7) Can you suggest some essential building blocks that are OS designer has to design for designing Linux Kernel? [01]  
(8) Why Linux is considered as most secure OS? [01]  
(9) List out any one major difference between Monolithic and Micro kernel designs [01]  
(10) What are the different entities that threads required to share with each other? [01]
- Q-2 (A) Consider the below details for CPU scheduler: [05]

|                   |      |   |   |   |
|-------------------|------|---|---|---|
| Arrival Time(ms): | 0    | 1 | 2 | 3 |
| Jobs/Process:     | A    | B | C | D |
| Burst Time(ms):   | 4    | 5 | 2 | 3 |
| *Priority:        | 1    | 2 | 3 | 4 |
| Time Slice:       | 2 ms |   |   |   |

\* Lower integer indicates highest priority.

For this data given, attempt the following:

- Calculate the waiting time and Average waiting time, Turn Around Time and Average Turnaround Time in milliseconds using SJF , Round Robin, SRTF and Preemptive version of priority algorithms.
  - Prepare tables for comparative analysis and derive the optimal solution using scheduling strategies mentioned above.
- Q-2 (B) Why Process Control - Blocks are maintained by OS during Process Management? Demonstrate the process context switching by CPU using proper use case and illustrations. [05]

OR

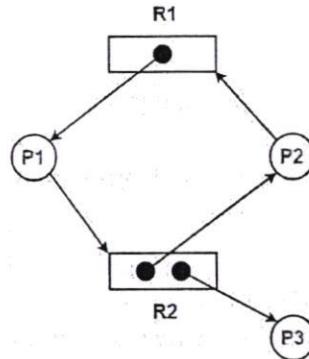
- Q-2 (B) Assume that there are 3 processes waiting under READY QUEUE. Kernel designer has decided to schedule and execute all of them in Round Robin fashion. If time taken to suspend one and resume another process by dispatcher is 2 ms and all processes are terminated after completing 3 rounds, then calculate the average dispatch latency in microseconds for the dispatcher. [05]

- Q-3 Attempt ANY TWO questions from following questions. [10]

- (A) Draw Process State Transition diagram. Under which conditions running processes should be moved from RUNNING to I/O wait queue?
- (B) How to achieve degree of multi-processing? Is it possible to store the information related to files opened by the specific process?
- (C) Compare Short Term, Medium Term and Long Term schedulers. What is the Convoy Effect?

## SECTION - II

- Q-4
- (1) Why we need noncontiguous memory allocation? [01]
  - (2) List out any three solutions / mechanism for IPC. [01]
  - (3) For any processes P1 and P2, Suggest the proper syntax flow to hold any resource of OS by P1 and wait for other resource hold by P2 and vice versa. [01]
  - (4) Can we take infinite size buffers to synchronize the Producer and Consumer processes? Why? [01]
  - (5) Under which conditions System can be in Unsafe state? [01]
  - (6) Draw any one Resource Allocation Graph which shows the deadlock. [01]
  - (7) How demands are generated in demand paging? [01]
  - (8) Draw Resource Allocation Table from below RAG: [01]



- (9) Why we always keep swap partition or virtual memory twice of size of actual RAM? [01]
  - (10) What is the role of polling in I/O? [01]
- Q-5 (A) Consider four memory partitions of size 10 KB, 20 KB, 30 KB, 40 KB. These partitions need to be allocated to four processes of sizes 9 KB, 19 KB, 29 KB and 39 KB in that order. Perform the allocation of processes using First Fit, Best Fit and Worst Fit Algorithms. Determine which algorithm makes the most efficient use of memory? Why? [05]

- Q-5 (B) Suppose there are two friends Karan & Arjun. Karan has a Black pen and expecting Red Pen from his Arjun without giving Black pen to him. Same way, Arjun is holding Red Pen and expecting Black pen from Karan. They are neither able to acquire their pens that they have demanded nor released their pens that they are holding. Demonstrate these scenario using two threads (Karan & Arjun) & Two Mutex Locks (Black & Red Pen). [05]

OR

- Q-5 (B) How Logical Address(LA) are translated into Physical Address(PA)? Why page tables are by default kept in main memory? [05]

- Q-6 Attempt ANY TWO questions from following questions. [10]

- (A) If the TLB hit Ratio is 50% and time required to access TLB & main memory is 40 ns and 100 ns respective then calculate the effective memory access time.
- (B) Consider a main memory with five page frames and the following sequence of page references: 3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3. Calculate the numbers of Page Faults in case of page replacement policies First-In-First-out (FIFO) and Least Recently Used (LRU). Which Page Replacement strategies gives less page faults?
- (C) How DMA controller can be useful in handling I/O? Illustrate step wise DMA functionalities in brief.

~:END OF PAPER:~

**GANPAT UNIVERSITY**  
**B. TECH. CSE SEM- IV(CBA/BDA/CS)**  
**CBCS REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2022**  
**2CSE402 OPERATING SYSTEM**

**MAX. TIME: 3 HRS****TOTAL MARKS: 60**

**Instructions:** (1) This Question paper has two sections. Attempt each section in separate answer book.  
(2) Figures on right indicate marks.  
(3) Assume suitable data if necessary.  
(4) Standard terms and notation are used.

**SECTION - I**

- Q-1 (1) List out any two characteristics of LINUX Kernel. [01]  
**Ans: File protection , Multi programming , multi-tasking , multi-threading.**
- (2) Why interrupts are essentials for any OS? [01]  
**Ans: Interrupts are important because they give the user better control over the computer. Without interrupts, a user may have to wait for a given application to have a higher priority over the CPU to be ran.**
- (3) Can we get list of processes under execution by CPU in Linux? How? [01]  
**Ans: Yes, using ps -a command**
- (4) List out any one privilege Instruction that make CPU to enter into kernel mode. [01]  
**Ans: Resetting PTBR, Page Tables, I/O handling etc.**
- (5) During process scheduling, why NEW QUEUE is maintained by OS? [01]  
**Ans: To maintain new jobs. all the processes get stored in the job queue. It is maintained in the secondary memory. The long term scheduler (Job scheduler) picks some of the jobs and put them in the primary memory.**
- (6) Which master process take care of re-parenting of orphan processes in LINUX? [01]  
**Ans: System INIT**
- (7) Can you suggest some essential building blocks that are OS designer has to design for designing Linux Kernel? [01]  
**Ans: Processes, Memory, I/O, Files**
- (8) Why Linux is considered as most secure OS? [01]  
**Ans: Secured, Reliable and Robustness because .exe is not there so parasitic virus cannot attack.**
- (9) List out any one major difference between Monolithic and Micro kernel designs [01]  
**Ans: Monolithic Kernel design implements both user and kernel services in the same address space. So less secured and if one module/service fails entire system failed. Whereas Micro logically separate out both.**
- (10) What are the different entities that threads required to share with each other? [01]  
**Ans: Each thread in a process shares code, data and resources.**

- Q-2 (A) Consider the below details for CPU scheduler: [05]

|                   |   |   |   |   |
|-------------------|---|---|---|---|
| Arrival Time(ms): | 0 | 1 | 2 | 3 |
| Jobs/Process:     | A | B | C | D |
| Burst Time(ms):   | 4 | 5 | 2 | 3 |
| *Priority:        | 1 | 2 | 3 | 4 |

|             |      |
|-------------|------|
| Time Slice: | 2 ms |
|-------------|------|

\* Lower integer indicates highest priority.

For this data given, attempt the following:

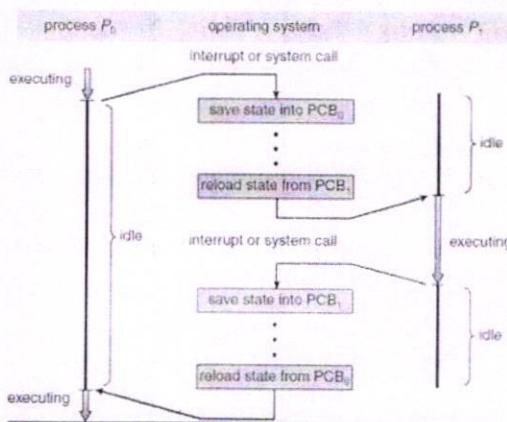
1. Calculate the waiting time and Average waiting time, Turn Around Time and Average Turnaround Time in milliseconds using SJF, Round Robin, SRTF and Preemptive version of priority algorithms.
2. Prepare tables for comparative analysis and derive the optimal solution using scheduling strategies mentioned above.

**Ans:** [https://www.tutorialspoint.com/operating\\_system/os\\_process\\_scheduling\\_algorithms.htm](https://www.tutorialspoint.com/operating_system/os_process_scheduling_algorithms.htm)

- Q-2 (B) Why Process Control Blocks are maintained by OS during Process Management? Demonstrate the process context switching by CPU using proper use case and illustrations. [05]

**Ans:**

**PCBs are maintained to store and resumed suspended processes during context switching as per below image.**



OR

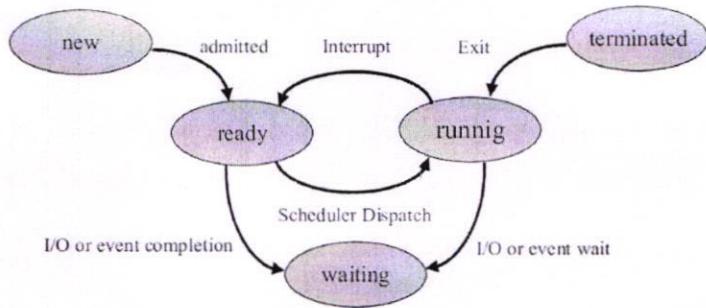
- Q-2 (B) Assume that there are 3 processes waiting under READY QUEUE. Kernel designer has decided to schedule and execute all of them in Round Robin fashion. If time taken to suspend one and resume another process by dispatcher is 2 ms and all processes are terminated after completing 3 rounds, then calculate the average dispatch latency in microseconds for the dispatcher. [05]

**Ans: 2ms x 3 processes x 3 rounds = 18 = 18000 microseconds**

- Q-3 Attempt ANY TWO questions from following questions. [10]

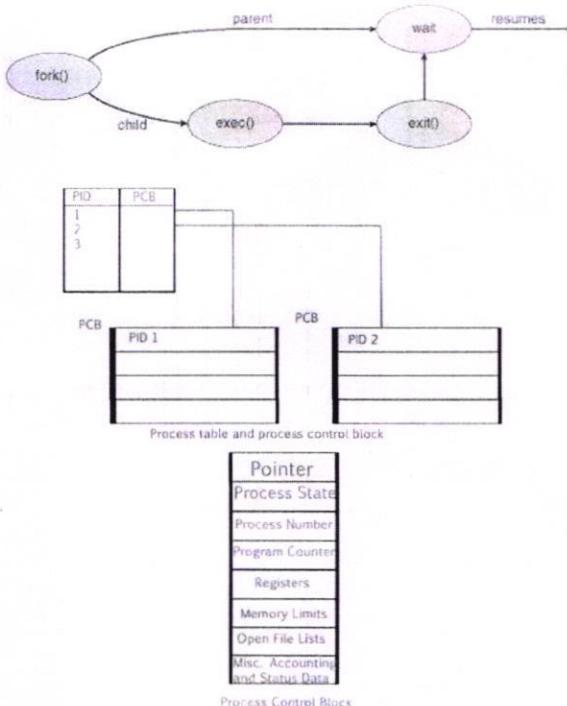
- (A) Draw Process State Transition diagram. Under which conditions running processes should be moved from RUNNING to I/O wait queue?

**Ans:**



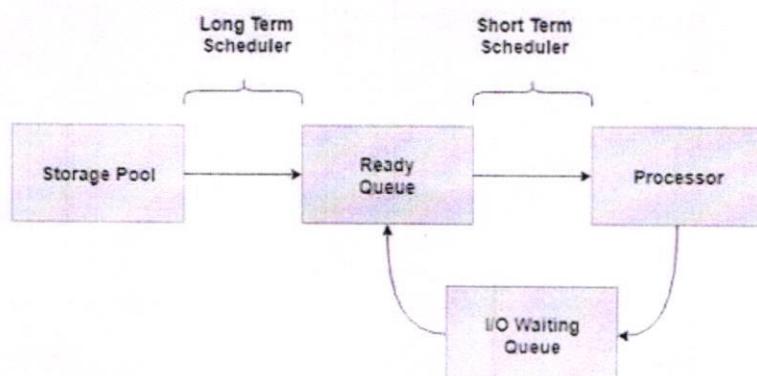
- (B) How to achieve degree of multi-processing? Is it possible to store the information related to files opened by the specific process?

**Ans:** Using Parent and Child Processes Concepts – `fork()` system call. Yes, it is possible to store the information related to files opened by the specific process using PCB.



- (C) Compare Short Term, Medium Term and Long Term schedulers. What is the Convoy Effect?

**Ans:**



Long-term scheduling involves selecting the processes from the storage pool in the secondary memory and loading them into the ready queue in the main memory for execution. This is handled by the long-term scheduler or job scheduler.

Short-term scheduling involves selecting one of the processes from the ready queue and scheduling them for execution. This is done by the short-term scheduler. A scheduling algorithm is used to decide which process will be scheduled for execution next by the short-term scheduler.

Medium-term scheduling involves swapping out a process from main memory. The process can be swapped in later from the point it stopped executing. This can also be called as suspending and resuming the process and is done by the medium-term scheduler.

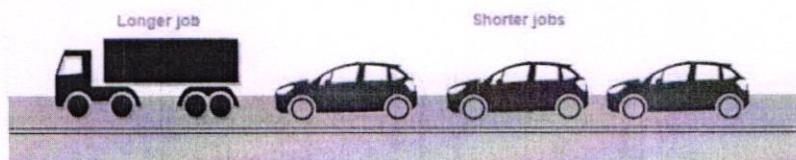


Figure - The Convoy Effect: Visualized

## SECTION - II

- Q-4 (1) Why we need noncontiguous memory allocation? [01]

**Ans: To avoid internal and external memory fragmentations**

- (2) List out any three solutions / mechanism for IPC. [01]

**Ans: PIPE, Shared Memory, Monitors, Message Queues**

- (3) For any processes P1 and P2, Suggest the proper syntax flow to hold any resource of OS by P1 and wait for other resource held by P2 and vice versa. [01]

**Ans:**

P1: `pthread_mutex_lock(&black_pen); pthread_mutex_lock(&red_pen);`

P2: `pthread_mutex_lock(&red_pen); pthread_mutex_lock(&black_pen);`

- (4) Can we take infinite size buffers to synchronize the Producer and Consumer processes? Why? [01]

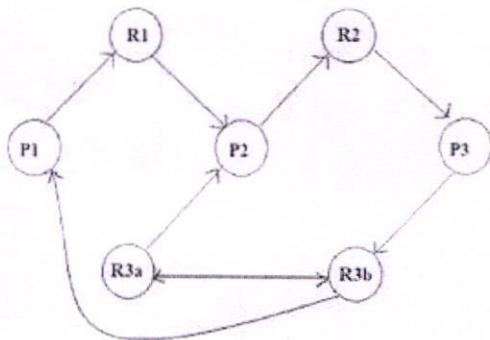
**Ans : No, Producer consumer problem is also referred as Bounded Buffer problem hence for infinite size buffer it does not exist.**

- (5) Under which conditions System can be in Unsafe state? [01]

**Ans: Deadlock**

- (6) Draw any one Resource Allocation Graph which shows the deadlock. [01]

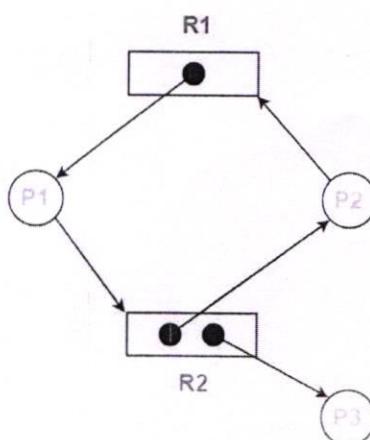
**Ans:**



- (7) How demands are generated in demand paging? [01]

**Ans: Using Page faults**

- (8) Draw Resource Allocation Table from below RAG: [01]



**Ans:**

|            | Allocation |    | Need |    |
|------------|------------|----|------|----|
|            | R1         | R2 | R1   | R2 |
| Process P1 | 1          | 0  | 0    | 1  |
| Process P2 | 0          | 1  | 1    | 0  |
| Process P3 | 0          | 1  | 0    | 0  |

- (9) Why we always keep swap partition or virtual memory twice of size of actual RAM? [01]

**Ans: To support SWAP partition – in case of main memory gets full – Swap IN Swap Out purpose**

- (10) What is the role of polling in I/O? [01]

**Ans: For CPU to check periodically if there is any I/O requests from any I/O.**

- Q-5 (A) Consider four memory partitions of size 10 KB, 20 KB, 30 KB, 40 KB. These partitions need to be allocated to four processes of sizes 9 KB, 19 KB, 29 KB and 39 KB in that order. Perform the allocation of processes using-

1. First Fit Algorithm
2. Best Fit Algorithm

### 3. Worst Fit Algorithm

Determine which algorithm makes the most efficient use of memory? Why?

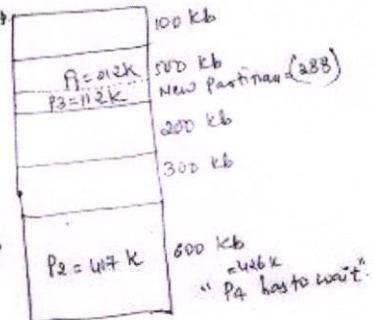
**Ans: Sample Example is given below:**

+ Memory Partitions :-  
 100 kb  
 500 kb  
 200 kb  
 300 kb  
 600 kb      in order.

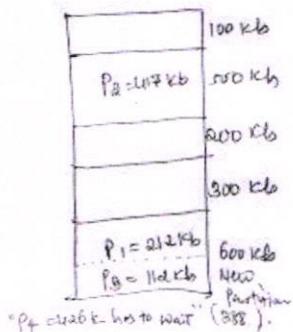
processes :-  
 $P_1 = 212 \text{ kb}$   
 $P_2 = 417 \text{ kb}$   
 $P_3 = 112 \text{ kb}$   
 $P_4 = 426 \text{ kb}$       in order

memory allocation  
 which algom makes the most efficient use of memory.

- 1) first fit :-  
 ↳ Allocate process to the first free hole which is large enough to accommodate the process.  
 Here, internal frag =  $(500 - 112) = 388 \text{ kb}$



- 2) worst fit :-  
 ↳ Allocate process to the largest available free hole/partition so that position left will be big enough to be useful.  
 ↳ It is reverse of Best fit



3) Best fit :-

↳ Allocate the process to the smallest free hole which meets our requirements.



in this example, Best fit turns out to be the best.

- Q-5 (B) Suppose there are two friends Karan & Arjun. Karan has a Black pen and expecting Red Pen from his Arjun without giving Black pen to him. Same way, Arjun is holding Red Pen and expecting Black pen from Karan. They are neither able to acquire their pens that they have demanded nor released their pens that they are holding. Demonstrate these scenario using two threads (Karan & Arjun) & Two Mutex Locks (Black & Red Pen). [05]

**Ans:**

```

void *pen1();
void *pen2();
pthread_mutex_t black_pen; //mutex lock1
pthread_mutex_t red_pen; //mutex lock2

int main()
{
 pthread_mutex_init(&black_pen,NULL); //initialize the lock1
 pthread_mutex_init(&red_pen,NULL); //initialize the lock2

 pthread_t karan,arjun;

 pthread_create(&karan,NULL,pen1,NULL); // create thread1
 pthread_create(&arjun,NULL,pen2,NULL); // create thread2

 pthread_join(karan,NULL);
 pthread_join(arjun,NULL);
}

```

```

printf("Both friends are joined\n");
}

void *pen1()
{
 pthread_mutex_lock(&black_pen);
 printf("Karan has black pen.\n");
 sleep(5);
 pthread_mutex_lock(&red_pen);
 printf("Karan has red pen.\n");
 sleep(5);
 pthread_mutex_unlock(&red_pen);
 printf("Karan has released red pen.\n");
 pthread_mutex_unlock(&black_pen);
 printf("Karan has released black pen\n");
}

void *pen2()
{
 pthread_mutex_lock(&red_pen);
 printf("Arjun has red pen.\n");
 sleep(5);
 pthread_mutex_lock(&black_pen);
 printf("Arjun has black pen.\n");
 sleep(5);
 pthread_mutex_unlock(&black_pen);
 printf("Arjun has released black pen.\n");
 pthread_mutex_unlock(&red_pen);
 printf("Arjun has released red pen.\n");
}

```

}

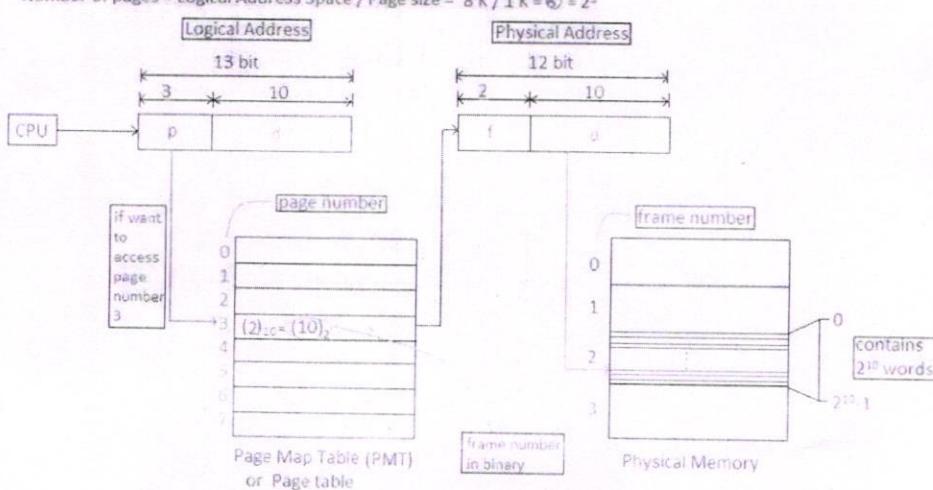
OR

- Q-5 (B) How Logical Address(LA) are translated into Physical Address(PA)? Why page [05] tables are by default kept in main memory?

**Ans:**

$$\text{Number of frames} = \text{Physical Address Space / Frame size} = 4 \text{ K} / 1 \text{ K} = 4 = 2^2$$

$$\text{Number of pages} = \text{Logical Address Space / Page size} = 8 \text{ K} / 1 \text{ K} = 8 = 2^3$$



Q-6 Attempt ANY TWO questions from following questions. [10]

- (A) If the TLB hit Ratio is 50% and time required to access TLB & main memory is 40 ns and 100 ns respective then calculate the effective memory access time.

**Ans:**

$$P = 50\% = 50/100 = 0.5, (1-P) = \text{Miss Ratio} = 0.5$$

$$\text{Hit memory time} = 40\text{ns} + 100\text{ns} = 140\text{ns}$$

$$\text{Miss memory time} = 40\text{ns} + 100\text{ns} + 100\text{ns} = 240\text{ns}$$

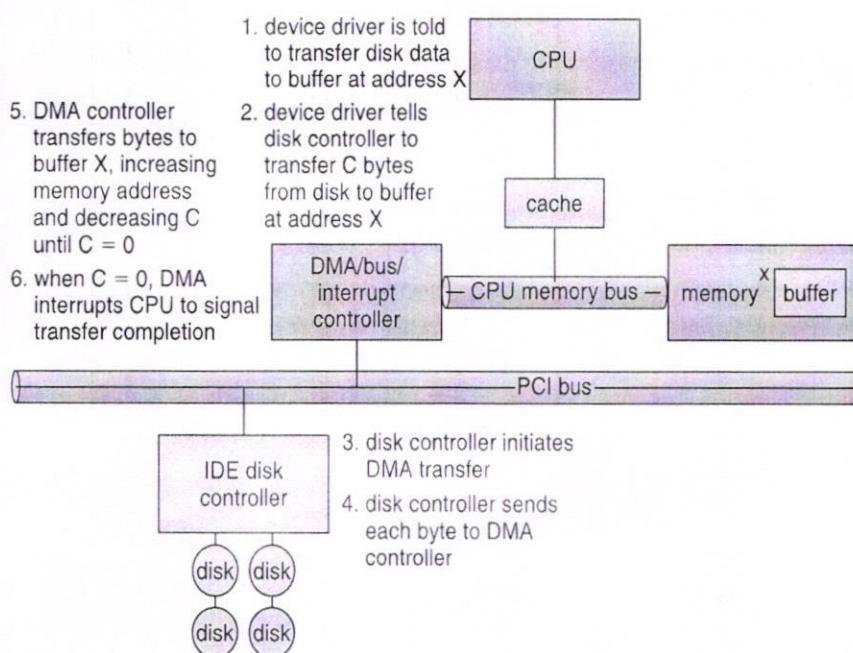
$$\text{Therefore, EAT} = P \times \text{Hit} + (1-P) \times \text{Miss} = 0.5 \times 140 + 0.5 \times 240 = 70 + 120 = 190 \text{ ns.}$$

- (B) Consider a main memory with five page frames and the following sequence of page references: 3, 8, 2, 3, 9, 1, 6, 3, 8, 9, 3, 6, 2, 1, 3. Calculate the numbers of Page Faults in case of page replacement policies First-In-First-out (FIFO) and Least Recently Used (LRU). Which Page Replacement strategies gives less page faults?

**Ans:** <https://www.geeksforgeeks.org/page-replacement-algorithms-in-operating-systems/>

- (C) How DMA controller can be useful in handling I/O? Illustrate step wise DMA functionalities in brief.

**Ans:**



~: END OF PAPER :~

**GANPAT UNIVERSITY****B. Tech. CSE (CBA/MA/CS/BDA) SEMESTER - IV****CBCS REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2022****(2CSE401) PROBABILITY AND STATISTICS****Max. Time: 3 HRS****TOTAL MARKS: 60****Instructions:** (1) This question paper has two sections. Attempt each section in separate answer book.

(2) Figures on right indicate marks.

(3) Assume suitable data if necessary.

(4) Standard terms and notation are used.

**SECTION-I**

- Q-1    1 For individual series of data, find the value of standard deviation from the given information:  $\Sigma y = 250$ ,  $\Sigma y^2 = 6840$ ,  $N = 10$  (02)
- 2 Calculate the value of variance for the given data: 1, 5, 6 (02)
- 3 Calculate the mean deviation about the median for this data: 89, 91, 54, 66, 13, 97, 6 (02)
- 4 The mean of four numbers is 12. With the removal of a number, the mean of remaining numbers is 15. What was the removed number? (02)
- 5 If a constant value is added to every observation of data, then how can we recomputing the arithmetic mean without using its equation? Give Example. (02)

- Q-2    (A) Differentiate between symmetric and asymmetric distribution. Discuss the types of Asymmetric Distribution in detail. (05)

- Q-2    (B) If the values of mean and standard deviation for the following frequency distribution (obtained by step deviation method) are 135.3 and 9.6 respectively. Find the value of interval between classes. (05)

|          |    |    |    |    |    |    |   |   |
|----------|----|----|----|----|----|----|---|---|
| <b>d</b> | -4 | -3 | -2 | -1 | 0  | 1  | 2 | 3 |
| <b>f</b> | 2  | 5  | 8  | 18 | 22 | 13 | 8 | 4 |

**OR**

- Q-2    (B) The annual rates of growth of an economy over the last five years were 1.5, 2.7, 3.0, 4.5 and 6.2 percent respectively. What is the average rate of growth per annum of the economy for the period? (05)

- Q-3 Answer following questions (Attempt any TWO)

- (A) Find mode of the following data using grouping method: (05)

|                  |    |    |    |    |    |    |    |
|------------------|----|----|----|----|----|----|----|
| <b>Value</b>     | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
| <b>Frequency</b> | 8  | 12 | 36 | 35 | 28 | 18 | 9  |

- (B) Find the median of following data: (05)

|              |      |       |       |       |        |
|--------------|------|-------|-------|-------|--------|
| <b>Class</b> | 0-20 | 20-40 | 40-60 | 60-80 | 80-100 |
| <b>Freq.</b> | 17   | 28    | 32    | 24    | 19     |

- (C) Show that Poisson distribution is a legitimate probability distribution also finds its mean and variance. (05)

$$P(X = r) = \frac{e^{-\lambda} \lambda^r}{r!} \text{ where } r = 0, 1, 2, \dots \text{ and } \lambda > 0$$

**SECTION-II**

- Q-4    1 State True/False: "Pearson coefficient of correlation can compute correlation for linear dependency between variables". Justify answer. (01)
- 2 If X is a continuous RV and its probability distribution is symmetric at  $X=5$ . What will be mean of the RV X? (01)
- 3 If  $P(A) = 5/12$  and  $P(B) = 1/12$  and  $P(A/B) = 1/15$  then  $P(A \cup B) = \underline{\hspace{2cm}}$  (01)
- 4 If Two events A and B are mutually exclusive events then  $P(B/A) = \underline{\hspace{2cm}}$  (01)
- 5 Give an example of an event having probability equal to 0.7. (01)
- 6 There are five players playing card game from 1 deck of card. At some point of time in a game all players are claiming to have an ACE. Is it possible? Justify answer by calculating probability of an event. (01)
- 7 Provide 5 elements of X and Y in such a way that coefficient of correlation between X and Y is 1. (i.e. fill data in table shown here) (02)
- |   |  |  |  |  |  |
|---|--|--|--|--|--|
| X |  |  |  |  |  |
| Y |  |  |  |  |  |
- 8 What will be the mean and variance of uniform distribution given below? (02)

$$f(x) = \frac{1}{8} \quad 2 \leq x \leq 10$$

- Q-5 (A) In a binary communication system, a '0' or '1' is transmitted. Because of the noise in the system , a '0', can be received as '1' with probability  $p$  and '1' can be received as '0' also with a probability  $p$ . Assuming that the probability that a '0' is transmitted is  $p_0$ . and that a '1' is transmitted is  $(1 - p_0)$ .
- (I) Find the probability that a '1' is received. (02)
- (II) Find the probability that a '1' was transmitted when a '0' is received. (03)

- Q-5 (B) The chances of A, B and C becoming the general manager of a company are in ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company if A, B, and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is probability that A has been appointed as general manager? (05)

**OR**

- Q-5 (B) The cdf of continuous RV X is given by  $F(x)$  then (05)
- (1) Find pdf of X  
(2) Find  $P(X \leq 1)$ .  
(3) Find  $P(\frac{1}{3} \leq X \leq 4)$ .  
(4) Find  $P(X \leq 10)$ .

$$F(x) = \begin{cases} 0 & x \leq 0 \\ x^2 & 0 \leq x \leq \frac{1}{2} \\ 1 - \frac{3}{25}(3-x)^2 & \frac{1}{2} \leq x \leq 3 \\ 1 & x \geq 3 \end{cases}$$

Q-6 Answer following questions (Attempt any TWO) (10)

(A) The joint probability distribution (05) of two dimensional discrete RV

$(X, Y)$  is given as shown in table.

- (1) Find  $P(X \leq 1)$
- (2) Find  $P(Y \leq 3)$
- (3) Find  $P(X \leq 1, Y \leq 3)$
- (4) Find  $P(X \leq 1 / Y \leq 3)$
- (5) Find  $P(X + Y \leq 4)$

| X | Y      |        |        |        |        |        |
|---|--------|--------|--------|--------|--------|--------|
|   | 1      | 2      | 3      | 4      | 5      | 6      |
| 0 | 0      | 0      | $1/32$ | $2/32$ | $2/32$ | $3/32$ |
| 1 | $1/16$ | $1/16$ | $1/8$  | $1/8$  | $1/8$  | $1/8$  |
| 2 | $1/32$ | $1/32$ | $1/64$ | $1/64$ | 0      | $2/64$ |

(B) Compute the coefficient of correlation between X and Y using following data (05)

|   |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|
| X | 65 | 67 | 66 | 71 | 67 | 70 | 68 | 69 |
| Y | 67 | 68 | 68 | 70 | 64 | 67 | 72 | 70 |

(C) The following table shows the ages (X) and blood pressure (Y) of 8 persons (05)

|   |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|
| X | 52 | 63 | 45 | 36 | 72 | 65 | 47 | 25 |
| Y | 62 | 53 | 51 | 25 | 79 | 43 | 60 | 33 |

Obtain the regression equation of Y on X and find the expected blood pressure of a person who is 49 years old.

-: END OF PAPER :-

**GANPAT UNIVERSITY**  
**B. Tech. CSE (CBA/MA/CS/BDA) SEMESTER - IV**  
**CBCS REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2022**  
**(2CSE401) PROBABILITY AND STATISTICS**

**Max. Time: 3 HRS****TOTAL MARKS: 60**

Instructions : (1) This question paper has two sections. Attempt each section in separate answer book.

- (2) Figures on right indicate marks.
- (3) Assume suitable data if necessary.
- (4) Standard terms and notation are used.

**SECTION-I**

|     |   |                                 |      |
|-----|---|---------------------------------|------|
| Q-1 | 1 | 7.68                            | (02) |
|     | 2 | 4.67                            | (02) |
|     | 3 | 29.14 or 29.15                  | (02) |
|     | 4 | 3                               | (02) |
|     | 5 | By adding the constant in mean. | (02) |

|     |     |                                             |      |
|-----|-----|---------------------------------------------|------|
| Q-2 | (A) | No Solution Required                        | (05) |
| Q-2 | (B) | $9.6 = (2.6-0.04)^{1/2} * i$<br>So, $i = 6$ | (05) |

**OR**

|     |                                              |                        |      |
|-----|----------------------------------------------|------------------------|------|
| Q-2 | (B)                                          | Geometric Mean = 3.5 % | (05) |
| Q-3 | Answer following questions (Attempt any TWO) |                        |      |

(A)

Q.3 (A)

|    | I  | II | III | IV | V  | VI |
|----|----|----|-----|----|----|----|
| 10 | 8  | 20 |     |    |    |    |
| 15 | 12 |    | 48  | 56 | 93 |    |
| 20 | 36 | 71 |     |    |    |    |
| 25 | 35 |    | 63  | 81 |    | 99 |
| 30 | 28 | 46 | 27  |    | 55 |    |
| 35 | 18 |    |     |    |    |    |
| 40 | 9  |    |     |    |    |    |

Analysis Table

| Column | 20 | 25 | 30 |
|--------|----|----|----|
| I      | ✓  |    |    |
| II     | ✓  | ✓  |    |
| III    |    | ✓  | ✓  |
| IV     |    | ✓  | ✓  |
| V      | ✓  | ✓  |    |
| VI     | ✓  | ✓  | ✓  |
|        | 4  | 5  | 3  |

So the mode is (25)

(B)

Q.3  
(B)

$$n = 120 \quad f = 32$$

$$L = 40 \quad C.f. = 45 \quad l = 20$$

$$\text{Median} = L + \frac{\frac{n}{2} - C.f.}{f} \times i = 49.375$$

- (C) Show that Poisson distribution is a legitimate probability distribution also finds its mean and variance. (05)

$$P(X = r) = \frac{e^{-\lambda} \lambda^r}{r!} \text{ where } r = 0, 1, 2, \dots \text{ and } \lambda > 0$$

Solution:

★ Poisson distribution

$$p(x=r) = \frac{e^{-\lambda} \lambda^r}{r!} \quad r=1, 2, 3, \dots$$

$\lambda > 0$

Here,  $e^x = 1 + \sum_{n=1}^{\infty} \frac{x^n}{n!} = 1 + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$

$$e^x = \sum_{n=0}^{\infty} \frac{x^n}{n!}$$

Now,

$$\begin{aligned} \sum p(x_i) &= \sum_{r=0}^{\infty} \frac{e^{-\lambda} \lambda^r}{r!} \\ &= e^{-\lambda} \sum \frac{\lambda^r}{r!} \\ &= e^{-\lambda} \cdot e^{\lambda} \\ &= 1 \end{aligned}$$

Hence, poisson distribution is  
a legitimate probability distribution

★ Mean

$$\begin{aligned} \bar{x} &= E[x] = \sum x_i p(x_i) \\ &= \sum_{r=0}^{\infty} r \cdot \frac{e^{-\lambda} \lambda^r}{r!} \\ &= \sum_{r=1}^{\infty} r \cdot \frac{e^{-\lambda} \lambda^r}{r!} \\ &= e^{-\lambda} \sum_{r=0}^{\infty} \frac{\lambda \cdot \lambda^{r-1}}{(r+1)!} \end{aligned}$$

$$= e^{-\lambda} \sum_{k=0}^{\infty} \frac{\lambda^k \lambda^{k-1}}{(k-0)!}$$

$$= \lambda e^{-\lambda} e^{\lambda}$$

$\text{mean} = \lambda$

★ Variance

$$\bar{x}^2 = E[x^2] = \sum x_i^2 p(x_i)$$

$$= \sum_{k=0}^{\infty} k^2 e^{-\lambda} \frac{\lambda^k}{k!}$$

$$= \sum_{k=1}^{\infty} k^2 e^{-\lambda} \frac{\lambda^k}{k!}$$

$$= e^{-\lambda} \left[ \sum_{k=1}^{\infty} [(k-1)+1] \frac{\lambda^k}{(k-1)!} \right]$$

$$= e^{-\lambda} \left[ \sum_{k=2}^{\infty} \frac{(k-1) \lambda^k}{(k-1)!} + \sum_{k=1}^{\infty} \frac{1 \cdot \lambda^k}{(k-1)!} \right]$$

$$= e^{-\lambda} \left[ \lambda^2 \sum_{k=2=0}^{\infty} \frac{\lambda^{k-2}}{(k-2)!} + \lambda \sum_{k=1=0}^{\infty} \frac{\lambda^{k-1}}{(k-1)!} \right]$$

$$= e^{-\lambda} [\lambda^2 e^{\lambda} + \lambda e^{\lambda}]$$

$$\bar{x}^2 = \lambda^2 + \lambda$$

$$\text{Var}[x] = \bar{x}^2 - (\bar{x})^2$$

$$= (\lambda^2 + \lambda) - (\lambda)^2$$

$\text{Var}[x] = \lambda$

**SECTION-II**

- Q-4 1 State True/False: "Pearson coefficient of correlation can compute correlation for linear dependency between variables". Justify answer. (01)

Solution:

True. Pearson coefficient cannot measure correlation between two variable who are dependent non linearly.

- 2 If X is a continuous RV and its probability distribution is symmetric at X=5. What will be mean of the RV X? (01)

Solution: mean is X=5

- 3 If  $P(A) = 5/12$  and  $P(B) = 1/12$  and  $P(A/B) = 1/15$  then  $P(A \cup B) = \underline{\hspace{2cm}}$  (01)

Solution:

$$P(A) = \frac{5}{12}, \quad P(B) = \frac{1}{12} \quad P(A/B) = \frac{1}{15}$$

$$P(A \cup B) = ?$$

$$\text{Now, } P(A/B) = \frac{P(A \cap B)}{P(B)}$$

$$\therefore P(A \cap B) = P(B) \cdot P(A/B) \\ = \frac{1}{12} \times \frac{1}{15} = \frac{1}{180}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$= \frac{5}{12} + \frac{1}{12} - \frac{1}{180}$$

$$= \frac{89}{180}$$

- 4 If Two events A and B are mutually exclusive events then  $P(B/A) = \underline{\hspace{2cm}}$  (01)

Solution:  $P(B/A) = 0$

- 5 Give an example of an event having probability equal to 0.7. (01)

Solution:

Event A :: select any number from 0 to 9 numbers and selected number is less than 7.

- 6 There are five players playing card game from 1 deck of card. At some point of time in a game all players are claiming to have an ACE. Is it possible? Justify answer by calculating probability of an event. (01)

Solution:

No, this cannot be possible because there are only 4 ACEs in 1 deck of cards. At a time not all five could possess it. So, probability of such event is ZERO.

- 7 Provide 5 elements of X and Y in such a way that coefficient of correlation between X and Y is 1. (i.e. fill data in table shown here) (02)

Solution:

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| X | 1 | 2 | 3 | 4 | 5 |
| Y | 1 | 2 | 3 | 4 | 5 |

- 8 What will be the mean and variance of uniform distribution given below? (02)

$$f(x) = \frac{1}{8} \quad 2 \leq x \leq 10$$

Solution:

Mean and variance of uniform distribution are as below

$$\text{Mean} = (a + b)/2 = (2+10)/2 = 6$$

$$\text{Variance} = (b - a)^2/12 = 64/12 = 5.33$$

- Q-5 (A) In a binary communication system, a '0' or '1' is transmitted. Because of the noise in the system, a '0', can be received as '1' with probability  $p$  and '1' can be received as '0' also with a probability  $p$ . Assuming that the probability that a '0' is transmitted is  $p_0$ , and that a '1' is transmitted is  $(1 - p_0)$ .

(I) Find the probability that a '1' is received. (02)

(II) Find the probability that a '1' was transmitted when a '0' is received. (03)

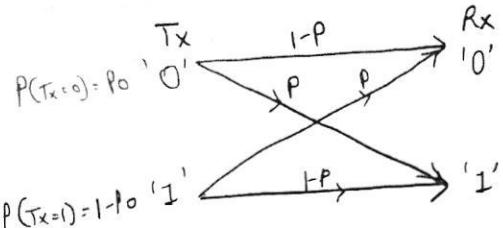
Solution:

$$P(Tx = 0) = p_0$$

$$P(Tx = 1) = 1 - p_0$$

$$P(Rx = 1 / Tx = 0) = p \Rightarrow P(Rx = 0 / Tx = 0) = 1 - p$$

$$P(Rx = 0 / Tx = 1) = p \Rightarrow P(Rx = 1 / Tx = 1) = 1 - p$$



$$\Rightarrow P(Rx = 1)$$

$$= P(Tx = 0) \cdot P(Rx = 1 / Tx = 0)$$

$$+ P(Tx = 1) \cdot P(Rx = 1 / Tx = 1)$$

$$= p_0(p) + (1 - p_0)(1 - p)$$

$$= 1 - p_0 - p + 2p_0p$$

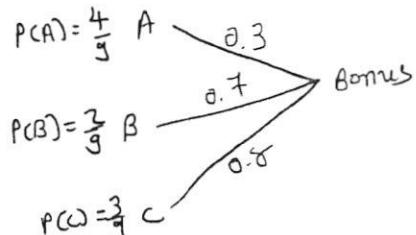
$$\begin{aligned}
 \Rightarrow & \underline{\underline{P(T_x=1/R_x=0)}} \\
 & = \frac{P(T_x=1) P(R_x=0/T_x=1)}{P(T_x=0) P(R_x=0/T_x=0) + P(T_x=1) P(R_x=0/T_x=1)} \\
 & = \frac{(1-p_0) \cdot p}{p_0(1-p) + (1-p_0)p} \\
 & = \frac{p - p_0 p}{p_0 + p - 2p_0 p}
 \end{aligned}$$

- Q-5 (B) The chances of A, B and C becoming the general manager of a company are in ratio 4:2:3. The probabilities that the bonus scheme will be introduced in the company if A, B, and C become general manager are 0.3, 0.7 and 0.8 respectively. If the bonus scheme has been introduced, what is probability that A has been appointed as general manager? (05)

Solution:

$$\begin{aligned}
 A:B:C &= 4:2:3 \\
 P(A) &= \frac{4}{4+2+3} = \frac{4}{9} & P(\text{Bonus}/A) &= 0.3 \\
 P(B) &= \frac{2}{4+2+3} = \frac{2}{9} & P(\text{Bonus}/B) &= 0.7 \\
 P(C) &= \frac{3}{4+2+3} = \frac{3}{9}
 \end{aligned}$$

$$\begin{aligned}
 \therefore P(\text{Bonus}) &= P(A) P(\text{Bonus}/A) \\
 &\quad + P(B) P(\text{Bonus}/B) \\
 &\quad + P(C) P(\text{Bonus}/C) \\
 &= \left(\frac{4}{9} \times 0.3\right) + \left(\frac{2}{9} \times 0.7\right) + \left(\frac{3}{9} \times 0.8\right) \\
 &= \frac{1}{9} (1.2 + 1.4 + 2.4) = \frac{5}{9}
 \end{aligned}$$



$$\begin{aligned} P(A/Bonus) &= \frac{P(A) \cdot P(Bonus/A)}{P(A) \cdot P(Bonus/A) + P(B) \cdot P(Bonus/B) \\ &\quad + P(C) \cdot P(Bonus/C)} \\ &= \frac{\left(\frac{4}{9} \times 0.3\right)}{\frac{5}{9}} \end{aligned}$$

$$= \frac{\frac{4}{9} \times 0.3 \times \frac{8}{5}}{\frac{5}{9}} = \frac{1.2}{5} = \frac{12}{50} = \frac{6}{25}$$

$P(A/Bonus) = \frac{6}{25}$

OR

- Q-5 (B) The cdf of continuous RV X is given by  $F(x)$  then

- (1) Find pdf of X
- (2) Find  $P(X \leq 1)$ .
- (3) Find  $P\left(\frac{1}{3} \leq X \leq 4\right)$ .
- (4) Find  $P(X \leq 10)$ .

Solution:

$$F(x) = \begin{cases} 0 & x \leq 0 \\ x^2 & 0 \leq x \leq \frac{1}{2} \\ 1 - \frac{3}{25}(3-x)^2 & \frac{1}{2} \leq x \leq 3 \\ 1 & x \geq 3 \end{cases} \quad (05)$$

$$F(x) = \begin{cases} 0 & x \leq 0 \\ x^2 & 0 \leq x \leq \frac{1}{2} \\ 1 - \frac{3}{25}(3-x)^2 & \frac{1}{2} \leq x \leq 3 \\ 1 & x \geq 3 \end{cases}$$

- (i) Find pdf of X

$$f(x) = \frac{d}{dx}(F(x))$$

$$f(x) = \begin{cases} 0 & x \leq 0 \\ 2x & 0 \leq x \leq \frac{1}{2} \\ \frac{6}{25}(3-x) & \frac{1}{2} \leq x \leq 3 \\ 0 & x \geq 3 \end{cases}$$

(ii) Find  $P(X \leq 1)$ 

$$\begin{aligned} P(X \leq 1) &= F(x=1) - F(x=-\infty) \\ &= \frac{13}{25} - 0 = \frac{13}{25} \end{aligned}$$

(iii) Find  $P(\frac{1}{3} \leq x \leq 4)$ 

$$\begin{aligned} P\left(\frac{1}{3} \leq x \leq 4\right) &= F(4) - F\left(\frac{1}{3}\right) \\ &= 1 - \frac{1}{9} = \frac{8}{9} \end{aligned}$$

(iv) Find  $P(X \leq 10)$ 

$$\begin{aligned} P(X \leq 10) &= F(10) - F(-\infty) \\ &= 1 - 0 = 1 \end{aligned}$$

Q-6 Answer following questions (Attempt any TWO)

(A) The joint probability distribution of two dimensional discrete RV (X,Y) is given as shown in table.

- (1) Find  $P(X \leq 1)$
- (2) Find  $P(Y \leq 3)$
- (3) Find  $P(X \leq 1, Y \leq 3)$
- (4) Find  $P(X \leq 1 / Y \leq 3)$
- (5) Find  $P(X + Y \leq 4)$

(05)

| X | Y    |      |      |      |      |      |
|---|------|------|------|------|------|------|
|   | 1    | 2    | 3    | 4    | 5    | 6    |
| 0 | 0    | 0    | 1/32 | 2/32 | 2/32 | 3/32 |
| 1 | 1/16 | 1/16 | 1/8  | 1/8  | 1/8  | 1/8  |
| 2 | 1/32 | 1/32 | 1/64 | 1/64 | 0    | 2/64 |

Solution:

$$\begin{aligned} (i) P(X \leq 1) &= P(X=0) + P(X=1) \\ &= \left(0 + 0 + \frac{1}{32} + \frac{2}{32} + \frac{2}{32} + \frac{3}{32}\right) + \left(\frac{1}{16} + \frac{1}{16} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}\right) \\ &= \frac{1}{4} + \frac{5}{8} \end{aligned}$$

$$\boxed{P(X \leq 1) = \frac{7}{8}}$$

$$\begin{aligned}
 \text{(ii)} \quad P(Y \leq 3) &= P(Y=1) + P(Y=2) + P(Y=3) \\
 &= \left(0 + \frac{1}{16} + \frac{1}{32}\right) + \left(0 + \frac{1}{16} + \frac{1}{32}\right) + \left(\frac{1}{32} + \frac{1}{8} + \frac{1}{64}\right) \\
 &= \frac{3}{32} + \frac{3}{32} + \frac{11}{64}
 \end{aligned}$$

$$P(Y \leq 3) = \frac{23}{64}$$

$$\text{(iii)} \quad P(X \leq 1, Y \leq 3) = \left(0 + 0 + \frac{1}{32}\right) + \left(\frac{1}{16} + \frac{1}{16} + \frac{1}{8}\right)$$

$$P(X \leq 1, Y \leq 3) = \frac{9}{32}$$

$$\begin{aligned}
 \text{(iv)} \quad P(X \leq 1 / Y \leq 3) &= \frac{P(X \leq 1, Y \leq 3)}{P(Y \leq 3)} \\
 &= \frac{9/32}{23/64}
 \end{aligned}$$

$$P(X \leq 1 / Y \leq 3) = \frac{18}{23}$$

$$\text{(v)} \quad P(X+Y \leq 4) = \frac{3}{32} + \frac{1}{4} + \frac{1}{16}$$

$$P(X+Y \leq 4) = \frac{13}{32}$$

(B) Compute the coefficient of correlation between X and Y using following data

(05)

|   |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|
| X | 65 | 67 | 66 | 71 | 67 | 70 | 68 | 69 |
| Y | 67 | 68 | 68 | 70 | 64 | 67 | 72 | 70 |

Solution:

| X - M <sub>x</sub>      | Y - M <sub>y</sub>      | (X - M <sub>x</sub> ) <sup>2</sup> | (Y - M <sub>y</sub> ) <sup>2</sup> | (X - M <sub>x</sub> )(Y - M <sub>y</sub> ) |
|-------------------------|-------------------------|------------------------------------|------------------------------------|--------------------------------------------|
| -2.875                  | -1.250                  | 8.266                              | 1.562                              | 3.594                                      |
| -0.875                  | -0.250                  | 0.766                              | 0.062                              | 0.219                                      |
| -1.875                  | -0.250                  | 3.516                              | 0.062                              | 0.469                                      |
| 3.125                   | 1.750                   | 9.766                              | 3.062                              | 5.469                                      |
| -0.875                  | -4.250                  | 0.766                              | 18.062                             | 3.719                                      |
| 2.125                   | -1.250                  | 4.516                              | 1.562                              | -2.656                                     |
| 0.125                   | 3.750                   | 0.016                              | 14.062                             | 0.469                                      |
| 1.125                   | 1.750                   | 1.266                              | 3.062                              | 1.969                                      |
| M <sub>x</sub> : 67.875 | M <sub>y</sub> : 68.250 | Sum: 28.875                        | Sum: 41.500                        | Sum: 13.250                                |

*X Values*

$$\sum = 543$$

$$\text{Mean} = 67.875$$

$$\sum(X - M_x)^2 = SS_x = 28.875$$

*Y Values*

$$\sum = 546$$

$$\text{Mean} = 68.25$$

$$\sum(Y - M_y)^2 = SS_y = 41.5$$

*X and Y Combined*

$$N = 8$$

$$\sum(X - M_x)(Y - M_y) = 13.25$$

*R Calculation*

$$r = \sum((X - M_y)(Y - M_x)) / \sqrt((SS_x)(SS_y))$$

$$r = 13.25 / \sqrt((28.875)(41.5)) = 0.3828$$

*Meta Numerics (cross-check)*

$$r = 0.3828$$

- (C) The following table shows the ages (X) and blood pressure (Y) of 8 persons

(05)

|   |    |    |    |    |    |    |    |    |
|---|----|----|----|----|----|----|----|----|
| X | 52 | 63 | 45 | 36 | 72 | 65 | 47 | 25 |
| Y | 62 | 53 | 51 | 25 | 79 | 43 | 60 | 33 |

Obtain the regression equation of Y on X and find the expected blood pressure of a person who is 49 years old.

Solution:

| X - M <sub>x</sub> | Y - M <sub>y</sub> | (X - M <sub>x</sub> ) <sup>2</sup> | (X - M <sub>x</sub> )(Y - M <sub>y</sub> ) |
|--------------------|--------------------|------------------------------------|--------------------------------------------|
| 1.375              | 11.25              | 1.8906                             | 15.4688                                    |
| 12.375             | 2.25               | 153.1406                           | 27.8438                                    |
| -5.625             | 0.25               | 31.6406                            | -1.4063                                    |
| -14.375            | -25.75             | 213.8906                           | 376.5938                                   |
| 21.375             | 28.25              | 456.8906                           | 603.8438                                   |
| 14.375             | -7.75              | 206.6406                           | -111.4063                                  |
| -3.625             | 9.25               | 13.1406                            | -33.5313                                   |
| -25.625            | -17.75             | 656.6406                           | 454.8438                                   |
| SS: 1733.875       |                    |                                    | SP: 1332.25                                |

Sum of  $X = 405$

Sum of  $Y = 406$

Mean  $X = 50.625$

Mean  $Y = 50.75$

Sum of squares ( $SS_X$ ) = 1733.875

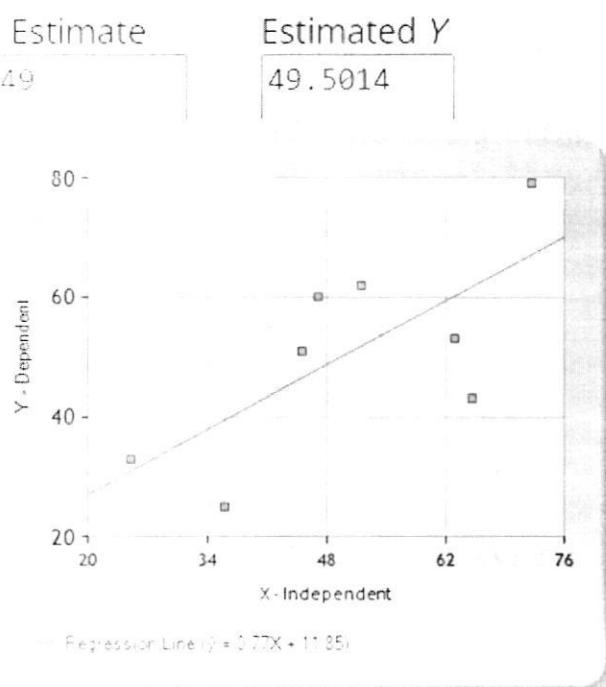
Sum of products ( $SP$ ) = 1332.25

Regression Equation =  $\hat{y} = bX + a$

$$b = SP/SS_X = 1332.25/1733.88 = 0.76837$$

$$a = M_Y - bM_X = 50.75 - (0.77 * 50.63) = 11.85149$$

$$\hat{y} = 0.76837X + 11.85149$$



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