Exam No: _____

GANPAT UNIVERSITY

B. Tech. CSE (CBA/MA/BDA) SEMESTER - IV

REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2018

(2CSE403) FUNCTIONAL PROGRAMMING

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

SECTION-I

Q-1

1. Slice operation on list is combination of _____and _____operation. **(01)**
2. Output of `X="hi",print("05d"%X)` is _____. **(01)**
3. What would be the output of the following? **(01)**

```
x = ['ab', 'cd']
for i in x:
    i.upper()
print(x)
```

4. The _____ keyword immediately ends the innermost loop, which contains the break. **(01)**
5. What would be the value of x if, `x = int(43.55+2/2)` **(01)**
6. How many characters are there in the string `"a\nb\x1f\000d"`? **(01)**
7. `L=[1,4,5,3] ,L[1 : 1]=[6,7] ;` what will be content of L ? **(01)**
8. Enlist two ways to build a list containing five integer zeros. **(01)**
9. Output of `chr('45')` is _____ **(01)**
10. _____ clause perform cleanup actions, whether exceptions occur or not. **(01)**

Q-2 (A)

I. Elaborate: "Python is interpreted, strongly and Dynamically typed language". **(02)**

II. (*Palindromic prime*) A *palindromic prime* is a prime number that is also palindromic. For example, **131** is a prime and also a palindromic prime, as are **313** and **757**. Write a program that displays the first 100 palindromic prime numbers. Display 10 numbers per line and align the numbers properly, as follows: **(03)**

```
  2   3    5    7   11  101  131  151  181  191
313 353  373  383  727  757  787  797  919  929
```

Q-2 (B) Create a 5 X 6 matrix having some random values and perform following operations on it: **(05)**

I. Sum All Elements
II. Sum up Elements by Column
III. Finding the Column with the Largest Sum
IV. Randomly shuffle the elements and then sort the elements of matrix.
V. Create a new row with user input values.

Exam No: _____

OR

Q-2 (B) I. Define Factory function and show its working using an appropriate example. **(03)**

II. What would be the output of the following of following code? Why? **(02)**

```
>>> X = 'Spam'
>>> def func():
        X = 'NI'
        def nested():
            print(X)
        nested()
>>> func()
>>> X
```

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

(A) Implement binary search approach to find the key in the list. (Note: Assume that the list is already in ascending manner) **(05)**

(B) Explain the LEGB rule with suitable code snippet. **(05)**

(C) Name and explain four operations that change a list object in place. **(05)**

SECTION-II

Q-4

1 What are the benefits of using exception handling? **(01)**

2 What is output of `print(list(d.keys()))` if `d = {"john":40, "peter": 45}`? **(01)**

3 Justify why *tuples* and *strings* are most frequently used type for defining keys of a dictionary. **(01)**

4 If `d = {"john":40, "peter": 45}` then what is output of `45 in d`? **(01)**

5 Tuple doesn't have any `update()` attribute. Why? **(01)**

6 Write a single line statement that can find number repeated data from the list. (Hint: use Set) **(01)**

7 Is the `a,b,c=1,2,3` piece of code valid? **(01)**

8 Which operator will return the symmetric difference between two sets, x and y? **(01)**

9 What would be the output of operation: **`s1 & s2`** If `s1={1,2,4}` and `s2={1,3,5}`. **(01)**

10 What will be the output of `2 * t` if `t = (1, 2)`? **(01)**

Q-5 (A) Write a program that read the text file *"input.txt"* and produce the text file *"summary.txt"*. *"summary.txt"* contains three lines, first line display total numbers of lines in file *"input.txt"*. Second line display total numbers of words in file *"input.txt"*. Third line display total numbers of character in file *"input.txt"*. **(05)**

Q-5 (B) Following code, contain few errors. Point out the mistakes and rewrite the correct code. **(05)**

```
class Vector
    def init(self,a=0,b=0):
        self.__x=a;
        self.__y=b;
    def __add__(self,v2):
        v3=Vector()
        v3.__x=self.__x+v2.__x
        v3.__y=self.__y+v2.__y
        return(v3)
    def __str__(self):
        return(" X= ",self.__x,",  Y = ",self.__y)
v1=Vector(3,4)
v2=Vector(5,5)
v3=v1*v2
print(v3)
```

OR

Q-5 (B) Implement stack class. Use a list to store the elements in a stack. Stack should have following functions: (1) Initializer (2) isEmpty function (3) push function (4) pop function (5) getSize function (6) print function **(05)**

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

(A) Does python support multiple inheritance? How do you define class that extends multiple classes? Justify answer by writing appropriate program. **(05)**

(B) Write a program that can calculate the value of *pi* from the area covered by circle using Monte Carlo method. **(05)**

(C) Design a class name *QuadraticEquation* for a quadratic equation $ax^2 + bx + c = 0$. **(05)**
The class contains:

- The private data fields *a*, *b*, and *c* that represent three coefficients.
- A constructor for the arguments for *a*, *b*, and *c*
- A method named *getDiscriminant()* that returns the discriminant, which is $b^2 - 4ac$
- The method named *getRoot1()* and *getRoot2()* for returning two roots of the equation using this formula.

This method are useful only if the discriminant is nonnegative. Let this method return 0 if the discriminant is negative.

-: END OF PAPER :-

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REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2018

(2CSE403) FUNCTIONAL PROGRAMMING

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

SOLUTION OF QUESTION PAPER

SECTION-I

Q-1 **1** **Slice operation on list is combination of _____and _____operation.** **(01)**

Insertion and deletion

2 **Output of `X="hi",print("05d"%X)` is _____.** **(01)**

```
TypeError: %d format: a number is required, not str
```

3 **What would be the output of the following?** **(01)**

```
x = ['ab', 'cd']
for i in x:
    i.upper()
print(x)
```

```
'AB'
['ab', 'cd']
'CD'
['ab', 'cd']
```

4 **The _____ keyword immediately ends the innermost loop, which contains the break.** **(01)**

Break

5 **What would be the value of `x` if, `x = int(43.55+2/2)`** **(01)**

44

6 **How many characters are there in the string `"a\nb\x1f\000d"`?** **(01)**

6

7 **`L=[1,4,5,3] ,L[1 : 1]=[6,7]` ; what will be content of L ?** **(01)**

```
[1, 6, 7, 4, 5, 3]
```

8 **Enlist two ways to build a list containing five integer zeros.** **(01)**

L=[0,0,0,0,0] and [0]**5

9 **Output of `chr('45')` is _____** **(01)**

```
TypeError: an integer is required (got type str)
```

10 **_____ clause perform cleanup actions, whether exceptions occur or not.** **(01)**

Finally

Q-2 (A) **I. Elaborate: "Python is interpreted, strongly and Dynamically typed language". (05)**

Strongly typed:

A strongly typed language is more likely to generate an error or refuse to compile if the argument passed to a function does not closely match the expected type. In a strongly typed language, you are simply not allowed to do anything that's incompatible with the type of data one is working with. In a strongly-typed language like python one can't do 'Hello' + 5 + 'Goodbye', because there's no defined way to "add" strings and numbers to each other.

Dynamic typing:

Python keeps track of the kinds of objects your program uses when it runs; it doesn't require complicated type and size declarations in your code. In fact, there is no such thing as a type or variable declaration anywhere in Python. Because Python code does not constrain data types, it is also usually automatically applicable to a whole range of objects.

Python is interpreted, which means that Python code is translated and executed by an interpreter,one statement at a time. Python is considered an interpreted language. It doesn't have a compiler; the interpreter processes the code line by line and creates a bytecode.

II. (*Palindromic prime*) A *palindromic prime* is a prime number that is also palindromic. For example, 131 is a prime and also a palindromic prime, as are 313 and 757. Write a program that displays the first 100 palindromic prime numbers. Display 10 numbers per line and align the numbers properly, as follows:

```
  2   3    5    7   11  101  131  151  181  191
313 353  373  383 727  757  787  797  919  929
```

```
def main():
    count = 1
    i = 2
    while count <= 100:
        # Display each number in five positions
        if isPrime(i) and isPalindrome(i):
            print(i, end = " ")
            if count % 10 == 0:
                print()
            count += 1 # Increase count
        i += 1
def isPrime(number):
    divisor = 2
    while divisor <= number / 2:
```

```
            if number % divisor == 0:
                # If true, number is not prime
                return False # number is not a prime
            divisor += 1
        return True # number is prime
    # Return the reversal of an integer, i.e. reverse(456)
    returns 654
    def isPalindrome(number):
        return number == reverse(number)
    # Return the reversal of an integer, i.e. reverse(456)
    returns 654
    def reverse(number):
        result = 0
        while number != 0:
            remainder = number % 10
            result = result * 10 + remainder
            number = number // 10
        return result

main()
```

Q-2 (B) **Create a 5 X 6 matrix having some random values and perform following operations on it:** **(05)**

I. Sum All Elements
II. Sum up Elements by Column
III. Finding the Column with the Largest Sum
IV. Randomly shuffle the elements and then sort the elements of matrix.
V. Create a new row with user input values.

```
matrix = [[1, 2, 3,2,3,1], [4, 5, 6,5,6,3], [7, 8,
9,9,8,7],[1,2,3,4,5,6],[2,2,3,3,4,4]
 # Assume a list is given for I,II,III
1) Summing All Elements:
total = 0
for row in matrix:
  for value in row:
       total += value
          print("Total is", total) # Print the total
2) Sum up  Elements by Column:
   for column in range(len(matrix[0])):
       total = 0
       for row in range(len(matrix)):
            total += matrix[row][column]
       print("Sum for column", column, "is", total)

3) Finding the Row with the Largest Sum:

maxRow = sum(matrix[0]) # Get sum of the first row in
```

```
maxRow
   indexOfMaxRow = 0
   for row in range(1, len(matrix)):
     if sum(matrix[row]) > maxRow:
          maxRow = sum(matrix[row])
          indexOfMaxRow = row
         print("Row", indexOfMaxRow, "has the maximum sum
of", maxRow)
```

4) Randomly shuffle the elements and then sort the matrix

```
   import random
   matrix = [[1, 2, 3,2,3,1], [4, 5, 6,5,6,3], [7, 8,
   9,9,8,7],[1,2,3,4,5,6],[2,2,3,3,4,4] # Assume a list
   for row in range(len(matrix)):
        for column in range(len(matrix[row])):
             i = random.randint(0, len(matrix) - 1)

             j = random.randint(0, len(matrix[row]) - 1)
             # Swap matrix[row][column] with matrix[i][j]
             matrix[row][column], matrix[i][j] =
        matrix[i][j], matrix[row][column]
             print(matrix)
             print (Sorted matrix:)
             print(matrix.sort())
```

5) Create a new row with user inputted values:

```
   matrix = [[1, 2, 3,2,3,1], [4, 5, 6,5,6,3], [7, 8,
   9,9,8,7],[1,2,3,4,5,6],[2,2,3,3,4,4] # Assume a list
   numberOfRows = eval(input("Enter the no. of rows you
want to create:" ))
   for row in range(numberOfRows):
        for column in range(len(matrix[row])):
             value = eval(input("Enter an element and
        press Enter: "))
             matrix[row].append(value)

        print (matrix)
```

OR

Q-2 (B) I. Define Factory function and show its working using an appropriate example. **(05)**

A simple function factory

Factory functions (a.k.a. closures) are sometimes used by programs that need to generate event handlers on the fly in response to conditions at runtime.

To illustrate this in simple terms, consider the following function:

```
>>> def maker(N):
```

```
    def action(X): # Make and return action
        return X ** N # action retains N from enclosing
    scope
    return action
```

This defines an outer function that simply generates and returns a nested function, without calling it—maker makes action, but simply returns action without running it.

If we call the outer function:

```
>>> f = maker(2)        # Pass 2 to argument N
>>> f
<function maker.<locals>.action at 0x0000000002A4A158>
```

what we get back is a reference to the generated nested function—the one created when the nested def runs. If we now call what we got back from the outer function:

```
>>> f(3)       # Pass 3 to X, N remembers 2: 3 ** 2
9
>>> f(4)          # 4 ** 2
16

>>> g = maker(3) # g remembers 3, f remembers 2
>>> g(4) # 4 ** 3
64
>>> f(4) # 4 ** 2
16
```

II. What would be the output of the following of following code? Why?

```
>>> X = 'Spam'
>>> def func():
        X = 'NI'
        def nested():
            print(X)
        nested()
>>> func()
>>> X
```

The output in this case is again 'NI' on one line and 'Spam' on another, because the print statement in the nested function finds the name in the enclosing function's local scope, and the print at the end finds the variable in the global scope.

3 Answer following questions (Attempt any TWO)

(A) Implement binary search approach to find the key in the list. (Note: Assume that the list is already in ascending manner) **(05)**

```
# Use binary search to find the key in the list
 def binarySearch(lst, key):
 low = 0
 high = len(lst) - 1
while(high>=low):
   mid = (low + high) // 2
   if( key< lst[mid]:
        high = mid - 1
    elif key == lst[mid]:
        return mid
    else:
         low = mid + 1
    return  -low-1# Now high < low, key not found
output:
     lst = [2, 4, 7, 10, 11, 45, 50, 59, 60, 66, 69, 70, 79]
     i = binarySearch(lst, 2)                    # Returns 0
     j = binarySearch(lst, 11)                  # Returns 4
     k = binarySearch(lst, 12)                # Returns -6
```

(B) Explain the LEGB rule with suitable code snippet. **(05)**

No solution required. Directly available in book

(C) Name and explain four operations that change a list object in place. **(05)**

The append and extend methods grow a list in place, the sort and reverse methods order and reverse lists, the insert method inserts an item at an offset, the remove and pop methods delete from a list by value and by position, the del statement deletes an item or slice, and index and slice assignment statements replace an item or entire section.

SECTION-II

Q-4 1 What are the benefits of using exception handling? **(01)**

Exceptions are convenient in many ways for handling errors and special conditions in a program. When you think that you have a code which can produce an error then you can use exception handling.

Advantage 1: Separating Error-Handling Code from "Regular" Code

Advantage 2: Propagating Errors Up the Call Stack

Advantage 3: Grouping and Differentiating Error Types

2 What is output of `print(list(d.keys()))` if `d = {"john":40, "peter": 45}`? **(01)**

```
['john', 'peter']
```

3 **Justify why *tuples* and *strings* are most frequently used type for defining keys of a dictionary.** (01)

Tuple and strings are immutable objects. So, they are most frequently used as the key of dictionary.

4 **If `d = {"john":40, "peter": 45}` then what is output of `45 in d`?** (01)

False

5 **Tuple doesn't have any `update()` attribute. Why?** (01)

Tuple is immutable objects. There is no sense in making update of immutable object.

6 **Write a single line statement that can find number repeated data from the list. (Hint: use Set)** (01)

```
l=[1,2,3,4,3,2,1]; len(l)-len(list(set(l)))
```

output:: 3

7 **Is the `a,b,c=1,2,3` piece of code valid?** (01)

Yes, `a=1, b=2, c=3`

8 **Which operator will return the symmetric difference between two sets, x and y?** (01)

`x^y`

9 **What would be the output of operation: `s1 & s2` If `s1={1,2,4}` and `s2={1,3,5}`.** (01)

{1}

10 **What will be the output of `2 * t` if `t = (1, 2)`?** (01)

`(1, 2, 1, 2)`

Q-5 (A) **Write a program that read the text file *"input.txt"* and produce the text file *"summary.txt"*. *"summary.txt"* contains three lines, first line display total numbers of lines in file *"input.txt"*. Second line display total numbers of words in file *"input.txt"*. Third line display total numbers of character in file *"input.txt"*.** (05)

```
file = open("input.txt","r");
chcount=0
linecount=0
wordcount=0
line=file.readline()
#print(line)
n=len(line)
while(n>0):
    line=line[:-1]
    print(line)
    linecount+=1
    wordcount+=len(line.split(" "))
    chcount+=len(line)
    line=file.readline()
    n=len(line)
file.close()
```

```
file=open("summary.txt","w")
file.write(" No. of Lines : "+str(linecount)+"\n")
file.write(" No. of Words : "+str(wordcount)+"\n")
file.write(" No. of Characters : "+str(chcount)+"\n")
file.close()
```

Q-5 (B) Following code, contain few errors. Point out the mistakes and rewrite the correct code. (05)

```
class Vector
    def init(self,a=0,b=0):
        self.__x=a;
        self.__y=b;
    def __add__(self,v2):
        v3=Vector()
        v3.__x=self.__x+v2.__x
        v3.__y=self.__y+v2.__y
        return(v3)
    def __str__(self):
        return(" X= ",self.__x,",  Y = ",self.__y)
v1=Vector(3,4)
v2=Vector(5,5)
v3=v1*v2
print(v3)
```

correct code is::

```
class Vector:
    def __init__(self,a=0,b=0):
        self.__x=a;
        self.__y=b;
    def __add__(self,v2):
        v3=Vector()
        v3.__x=self.__x+v2.__x
        v3.__y=self.__y+v2.__y
        return(v3)
    def __str__(self):
        return(" X= "+str(self.__x)+",  Y = "+str(self.__y))
v1=Vector(3,4)
v2=Vector(5,5)
v3=v1+v2
print(v3)
```

OR

Q-5 (B) Implement stack class. Use a list to store the elements in a stack. Stack should have following functions: (1) Initializer (2) isEmpty function (3) push function (4) pop function (5) getSize function (6) print function (05)

```
class stack:
    def __init__(self):
        self.__elements=[]
    def isEmpty(self):
        return(len(self.__elements)==0)
```

```
    def peek(self):
        if(self.isEmpty()):
            return(None)
        else:
            return(self.__elements[-1])
    def push(self,value):
        self.__elements.append(value)
    def pop(self):
        if(self.isEmpty()):
            return(None)
        else:
            return(self.__elements.pop())
    def getSize(self):
        return(len(self.__elements))
    def print(self):
        print(self.__elements)

s1=stack()
s1.print()
s1.isEmpty()
s1.push(10)
s1.print()
s1.isEmpty()
s1.peek()
s1.print()
s1.pop()
s1.print()
```

Q-6 Answer following questions (Attempt any TWO)

(A) Does python support multiple inheritance? How do you define class that extends multiple classes? Justify answer by writing appropriate program. **(05)**

```
#definition of the class starts here
class Person:
    #defining constructor
    def __init__(self, personName, personAge):
        self.name = personName
        self.age = personAge
    #defining class methods
    def showName(self):
        print(self.name)
    def showAge(self):
        print(self.age)
    #end of class definition
# defining another class
class Student: # Person is the
    def __init__(self, studentId):
```

```
        self.studentId = studentId
    def getId(self):
        return self.studentId
class Resident(Person, Student): # extends both Person and
Student class
    def __init__(self, name, age, id):
        Person.__init__(self, name, age)
        Student.__init__(self, id)
# Create an object of the subclass
resident1 = Resident('John', 30, '102')
resident1.showName()
print(resident1.getId())
```

(B) Write a program that can calculate the value of pi from the area covered by circle using Monte Carlo method. **(05)**

```
from random import random
from math import sqrt
import matplotlib.pyplot as plt
n=1000
count=0;
r=1;
for i in range(n):
    x=(random()*2*r)-r
    y=(random()*2*r)-r
    d=sqrt((x*x)+(y*y))
    if(d<=r):
        count+=1
        plt.plot(x,y,'ro')
    else:
        plt.plot(x,y,'ko')
prob_c=count/n
pi=4*prob_c
print("pi = ",pi)
plt.show()
```

(C) Design a class name *QuadraticEquation* for a quadratic equation $ax^2 + bx + c = 0$. The class contains: **(05)**

- **The private data fields *a*, *b*, and *c* that represent three coefficients.**
- **A constructor for the arguments for *a*, *b*, and *c***
- **A method named *getDiscriminant()* that returns the discriminant, which is $b^2 - 4ac$**
- **The method named *getRoot1()* and *getRoot2()* for returning two roots of the equation using this formula.**

This method are useful only if the discriminant is nonnegative. Let this method return 0 if the discriminant is negative.

SOLUTION

```
from math import *
class QuadraticEquation:
    def __init__(self,x=0,y=0,z=0):
        self.__a=x
        self.__b=y
        self.__c=z
    def getDiscriminant(self):
        return((self.__b*self.__b)-(4*self.__a*self.__c))
    def getRoot1(self):
        if(self.getDiscriminant()<0):
            return(0)
        else:
           return((-self.__b+sqrt(self.getDiscriminant()))/
                                                  (2*self.__a))
    def getRoot2(self):
        if(self.getDiscriminant()<0):
            return(0)
        else:
           return((-self.__b- sqrt(self.getDiscriminant()))/
                                                 (2*self.__a) )
#eq1=QuadraticEquation(1,-5,6)
eq1=QuadraticEquation(1,-1,1)
print(eq1.getDiscriminant())
print(eq1.getRoot1())
print(eq1.getRoot2())
```

-: END OF PAPER :-

Exam No: _____

GANPAT UNIVERSITY

B. Tech. CSE (CBA/MA/BDA) SEMESTER - IV

REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2018

(2CSE401) PROBABILITY & STATISTICS

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

Instruction:

1. **All questions are compulsory and start each question on new page.**
2. **Figure on the right indicate maximum marks.**
3. **Standard terms and notation are used.**
4. **Assume suitable data if necessary**

SECTION-I

Q-1 **1** The variance of a random variable X is σ_x^2. Then the variance of $-kX$ (where k is a positive constant) is _____ **(01)**

2 The pdf of Gaussian Random variable X is given by $P_X(x)$, Find out its mean and variance. $P_X(x) = \frac{1}{3\sqrt{2\pi}} e^{-\frac{(x-4)^2}{18}}$ **(01)**

3 If the probability density function is divided into three regions as shown in the figure 1, the value of a in the figure below is: **(01)**

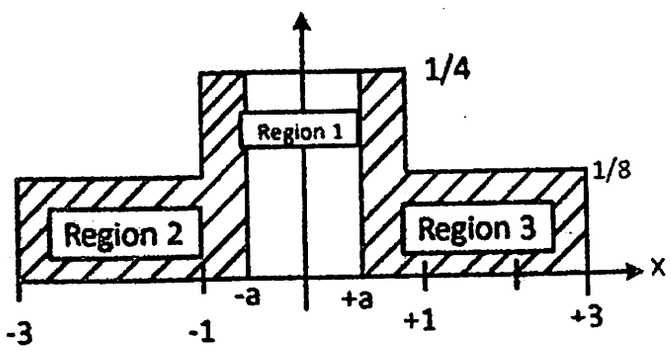


Figure 1 Probability distribution

4 A probability density function is given by $(x) = Kexp(-x)$, $-\infty < x < \infty$. Calculate the value of K. **(01)**

5 If events A depends on event B and C, P(A and B) = 0.30, P(A and C) = 0.20 and the events B and C are mutually exclusive, then P(C/A) is equal to _____ ? **(01)**

6 A fair coin is tossed till a head appears for the first time. Find The probability that the number of required tosses is odd. **(01)**

7 For a strict-sense stationary process, what can you say about the joint probability distributions at different values of time? **(01)**

8 How are statistics and probability related? **(01)**

9 What is relative frequency definition of probability? **(01)**

10 Variance of Uniform distribution $U(c,d)$ is _____. **(01)**

Q-2 **(A)** **I.** Can events be independent and mutually exclusive? Give an example. **(02)**

II. A continuous random variable has a pdf $f(x) = k\,x^2e^{-x}$ $x \geq 0$. Find k , mean and variance **(03)**

Exam No: _____

Q-2 (B) **I.** List four differences between probability distribution function and cumulative distribution function. **(02)**

II. For the bivariate probability distribution of (X,Y) given below, Find **(03)**

(a) P(X≤1) (b) P(Y≤4) (c) P(X≤1,Y≤4)
(d) P(Y≤4|X≤1) (e) P(X+Y≤5) (f) P(X≤2)

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

OR

Q-2 (B) A random variable X has the above probability distribution. Find (a) the value of K (b) P((1.5<X<5) | x>2) **(05)**

x	0	1	2	3	4	5	6	7
P(X)	0	K	2k	2k	3k	K^2	$2k^2$	$7k^2+k$

Q-3 Answer following questions (Attempt any FOUR) **(10)**

(A) List three differences between stationary and ergodic random processes.

(B) What is a continuous random sequence?

(C) Calculate the first moment of normal distribution.

(D) Give a practical example of (a) Poisson distribution (b) Uniform distribution

(E) For a random variable 'X' following the probability density function, $p(x)$, shown in figure 2, calculate the mean and the variance.

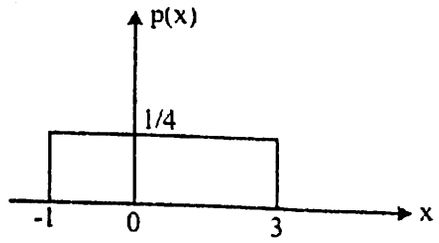


Figure 2: Probability distribution of RV X

SECTION-II

Q-4

1 If the event A and event B are independent events, then $P(A/B) =$ _____ **(01)**

2 For a left skewed distribution, how are mean, median, mode related. Draw a left skewed distribution and write in one line. **(01)**

3 $F[E[X]] - F[-\infty] - F[\infty] =$ _____where X is continuous RV over $[-\infty, \infty]$ **(01)**

4 A negative correlation between two random variables X and Y mean that, with increase in values of X , Y values _____ **(01)**

5 $F[E[E[X]]] =$ _____ where X is continuous RV over [-∞,∞] **(01)**

6 _____ is called positional average **(01)**

7 If Correlation coefficient of X and Y is r then Correlation coefficient of $aX + b$ and $hY + k$ is _____ **(01)**

8 Write whether the statement is true or false: 57% of the data lie between mean ± quartile deviation. **(01)**

9 $variance[a] =$ _____ where a is the constant. **(01)**

10 For same data, why we get two different lines of regression? **(01)**

Exam No: _____

(A) Define the terms (1) Symmetrical distribution. (2) Asymmetric distribution. **(05)**

Q-5 (B) The table below gives the weight measurements of 200 castings: **(05)**

Weight in Kg.	No. of Casting		Weight in Kg.	No. of Casting
81-90	2		141-150	37
91-100	5		151-160	29
101-110	13		161-170	11
111-120	20		171-180	3
121-130	30		181-190	1
131-140	49		---	---

Calculate arithmetic mean and variance.

OR

Q-5 (B) I. 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 compound rate of growth per annum of the economy for the period? **(03)**

II. Calculate the median from the following data: **(02)**

Weight	No. of Apples		Weight	No. of Apples
410-419	14		450-459	45
420-429	20		460-469	18
430-439	42		470-479	7
440-449	54		---	---

Q-6 Answer following questions (Attempt any TWO)

(A) Compute the coefficient of correlation between X and Y from the following data: **(05)**

X:	80	45	55	56	58	60	65	68	70	75	85
Y:	82	56	50	48	60	62	64	65	70	74	90

(B) Obtain the line of regression of X on Y from the following data. Find the value of X when Y=45 **(05)**

X:	4.7	8.2	12.4	15.8	20.7	24.9	31.9	35.0	39.1	38.8
Y:	4.0	8.0	12.5	16.0	20.0	25.0	31.0	36.0	40.0	40.0

(C) Calculate the value of mode for following data: **(05)**

X	30	25	20	40	45	35	15
Frequency	35	36	12	18	9	28	8

-: END OF PAPER :-

GANPAT UNIVERSITY

B. Tech. CSE (CBA/MA/BDA) SEMESTER - IV

REGULAR/REMEDIAL EXAMINATION APRIL-JUNE 2018

(2CSE401) PROBABILITY & STATISTICS

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

Instruction:

1. **All questions are compulsory and start each question on new page.**
2. **Figure on the right indicate maximum marks.**
3. **Standard terms and notation are used.**
4. **Assume suitable data if necessary**

SOLUTION OF QUESTION PAPER

SECTION-I

Q-1 **1** The variance of a random variable X is σ_x^2. Then the variance of $-kX$ (where k is a positive constant) is _____ **(01)**

$$Var(-kX) = E[(-kX)^2]$$

$$\sigma^2 = E[k^2X^2]$$

$$= k^2E[X^2]$$

$$= k^2\sigma_x^2$$

2 The pdf of Gaussian RV X is given by $P_X(x)$, Find out its probability at $x = 4$, **(01)**

$$P_X(x) = \frac{1}{3\sqrt{2\pi}} e^{-\frac{(x-4)^2}{18}}$$

3 If the probability density function is divided into three regions as shown in the figure 1, the value of a in the figure below is_____ **(01)**

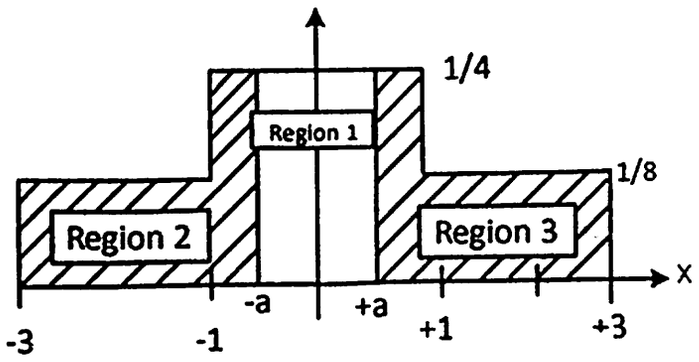


Figure 1 Probability distribution

The area under the Pdf curve must be unity. All three regions are equi -probable, thus area under each region must be $\frac{1}{3}$.

Area of region 1 $= 2a \times \frac{1}{4}$

$$\frac{2a}{4} = \frac{1}{3} \text{ or } a = \frac{2}{3}$$

4 A probability density function is given by $(x) = Kexp(-x^2/2)$, $-\infty < x < \infty$. Calculate the value of K. **(01)**

Soln. Gaussian Probability density of a random variable X is given by

$$P_X(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\left[\frac{(x-\mu)^2}{2\sigma^2}\right]}$$

When $\sigma = 1$ and $\mu = 0$ (zero mean)

$$P_X(x) = \frac{1}{\sqrt{2\pi}} e^{\frac{-x^2}{2}}$$

$$\text{Given } P_{(x)} = ke^{\frac{-x^2}{2}}$$

$$\text{So, } k = \frac{1}{\sqrt{2\pi}}$$

for given Question $K = 0$

for $f(x) = ke^{-x}$

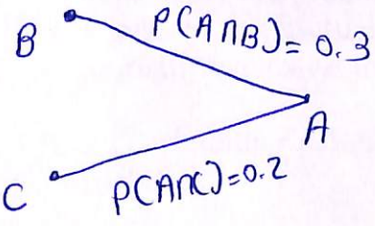
$\int_{-\infty}^{\infty} ke^{-x} = 1$

$2K\left[\int_{-\infty}^{\infty} e^{-x}\right] = 1$

$2K\left[e^{-x}\right]_{-\infty}^{\infty} = 1$

$2K\left[e^{-\infty} - e^{\infty}\right] = 1$ | $2K[0-\infty] = 1$, $K = -\infty$

5 If an event A depends on event B and C, P(A and B) = 0.30, P(A and C) = 0.20 and the events B and C are mutually exclusive, then P(C/A) is equal to 0.4 ? **(01)**



$P(A) = P(A \cap B) + P(A \cap C)$

$= 0.3 + 0.2$

$= 0.5$

$P(C/A) = \frac{P(C \cap A)}{P(C)} = \frac{0.2}{0.5}$

$= 0.4$

6 A fair coin is tossed until a head appears for the first time. Find The probability that the number of required tosses is odd. **(01)**

7 For a strict-sense stationary process, what can you say about the joint probability distributions at different values of time? **(01)**

Ans: Joint distributions of $x(t1)$, $x(t2)$ are equal at time t and at time $x(t1+\alpha)$, $x(t2+\alpha)$ i.e; joint probability are equal even after a time delay.

8 How are statistics and probability related? **(01)**

Probability deals with predicting the likelihood of future events, while statistics involves the analysis of the frequency of past events. Probability is primarily a theoretical branch of mathematics, which studies the consequences of mathematical definitions

9 What is relative frequency definition of probability? **(01)**

We will consider the frequentist definition of probability, as it is the one that currently is the most widely held. To do this we need to define two concepts: (i) sample space, and (ii) relative frequency. 1. Sample space, S, is the collection [sometimes called universe] of all possible outcomes. For a stochastic system, or an experiment, the sample space is a set where each outcome comprises one element of the set. 2. Relative frequency is the proportion of the sample space on which an event E occurs. In an experiment with 100 outcomes, and E occurs 81 times, the relative frequency is 81/100 or 0.81. The frequentist approach is based on the notion of statistical regularity; i.e., in the long run, over replicates, the cumulative relative frequency of an event (E) stabilizes. The best way to illustrate this is with an example experiment that we run many times and measure the cumulative relative frequency (crf). The crf is simply the relative frequency computed cumulatively over some number of replicates of samples, each with a space S.

10 Variance of Uniform distribution U(c,d) is $\frac{(c-d)^2}{12}$ **(01)**

Q-2 **(A)** **I.** Can events be independent and mutually exclusive? Give an example. **(02)**

Since P(B) > 0 and P(B, A) = 0, the requirement that an event be contained by A does affect the probability of B occurring, so A and B are not independent. Thus, if A and B are mutually exclusive, they are not independent. If two events are mutually exclusive, they are as dependent as two events can be. **(03)**

II. A continuous random variable has a pdf $f(x) = k\,x^2e^{-x}$ $x \geq 0$. Find k , mean and variance

$$\int_0^\infty f(x)\,dx = 1$$

$$\therefore \int_0^\infty k\,x^2 e^{-x}\,dx = 1$$

$$\therefore k\lfloor 3 = 1$$

$$\therefore k = \frac{1}{2!}$$

$$\therefore \boxed{k = 1/2}$$

$$E[x] = \int x f(x)\,dx$$

$$= \int_0^\infty k x^3 e^{-x}\,dx$$

$$= k \cdot \lfloor 4$$

$$= k \cdot 3!$$

$$= \frac{6}{2}$$

$$\boxed{\bar{x} = 3}$$

$$E[x^2] = \int x^2 f(x)\,dx$$

$$= \int_0^\infty k x^4 e^{-x}\,dx$$

$$= k \lfloor 5$$

$$= k \cdot 4!$$

$$= \frac{24}{2} = 12$$

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

$$= 12 - (3)^2$$

$$\boxed{\text{Var}[x] = 3}$$

(B) **I.** List four differences between probability distribution function and cumulative distribution function. **(02)**

(03)

Diff 1 : Their definitions
Diff2 : Their formulas
Diff3: Sum of all the probabilities for PDF is 1 but , in CDF probabilities upto that point is equal to 1
Diff4: CDF is easy to compute, while pdf is not . Reason : Though both give probabilities, if one has to compute probability over a range of a continuous variable using CDF is just subtraction of probabilities over the range. Whereas using PDF we have to add over the entire range.

When using standard normal variables, CDF is easy as every variable can be converted to standard normal variable and using z-table we can compute the values of probabilities over a range.

II. For the bivariate probability distribution of (X,Y) given below, Find
(a) $P(X\leq 1)$ (b) $P(Y\leq 4)$ (c) $P(X\leq 1, Y\leq 4)$
(d) $P(Y\leq 4|X\leq 1)$ (e) $P(X+Y\leq 5)$ (f) $P(X\leq 2)$

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

Soln :-

X \ Y	1	2	3	4	5	6	P(Y)
0	0	0	0.03125	0.0625	0.0625	0.09375	0.25
1	0.0625	0.0625	0.125	0.125	0.175	0.125	0.625
2	0.0312	0.0312	0.0156	0.0156	0	0.0312	0.125
P(X)	0.0937	0.0937	0.1718	0.2031	0.1875	0.25	1

(a) $P(X\leq 1) = P(X=0) + P(X=1) = 0.25 + 0.625 = 0.875$

(b) $P(Y\leq 4) = P(Y=1) + P(Y=2) + P(Y=3) + P(Y=4)$
$= 0.0937 + 0.0937 + 0.1718 + 0.2031$
$= 0.5623$

(c) $P(X\leq 1, Y\leq 4) = 0.25 + 0.1875 + 0.03125 = 0.4687$

(d) $P(Y\leq 4 / X\leq 1) = \frac{P(X\leq 1, Y\leq 4)}{P(X\leq 1)} = \frac{0.4687}{0.875} = 0.5357$

(e) $P(X+Y\leq 5) = 0.61$

(f) $P(X\leq 2) = 1$

OR

(B) A random variable X has the above probability distribution. Find (a) the value of K **(05)**
(b) P((1.5<X<5) | x>2)

x	0	1	2	3	4	5	6	7
P(X)	0	K	2k	2k	3k	K^2	$2k^2$	$7k^2+k$

(a) $\sum_{i=1}^{7} P(x_i) = 1$

$K + 2K + 2K + 3K + K^2 + 2K^2 + 7K^2 + K = 1$

~~$3K^2 + 7K + 9 = 1$~~

~~$\therefore 3K^2 + 10K^2 - 7K + 9 = 1$~~

$10K^2 + 9K = 1$

$\therefore (10K - 1)(K + 1) = 0$

$K = 1/10$ or -1

if $K = -1$ then $P(X=1)$ will give you negative Probability

$\therefore \boxed{K = 1/10}$

X	0	1	2	3	4	5	6	7
P(X)	0	0.1	0.2	0.2	0.3	0.01	0.02	0.17

$$P(1.5 < x < 5 / x > 2) = \frac{P((1.5 < x < 5) \cap (x > 2))}{P(x > 2)}$$

$$= \frac{P(x=3) + P(x=4)}{P(x>2)}$$

$$= \frac{5/10}{7/10} = 5/7$$

Solution

Answer following questions (Attempt any FOUR) **(10)**

(A) List three differences between stationary and ergodic random processes.

Diff1: definitions of both

Diff2: stationary process is of two types – SSS, WSS where as no sub classifications of ergodic process.

A random process is a collection of random variables, one for each time instant under consideration. Typically this may be continuous time ($-\infty<t<\infty$) or discrete time (all integers n, or all time instants nT where T is the sample interval). Stationarity refers to the distributions of the random variables, ergodicity takes into account the sample paths, i.e. what you observe physically. As you say, the average value or DC component of a sample path converges to the mean value of the process if the sample path is observed long enough, provided the process is ergodic and stationary, etc.

As an example of the difference between the two concepts, suppose that X(t)=Y for all t under consideration. Here Y is a random variable. This is a stationary process: each X(t) has the same distribution (the distribution of Y), same mean E[X(t)]=E[Y], same variance etc.; each X(t1) and X(t2) have the same joint distribution (though it is degenerate) and so on. But the process is not ergodic because each sample path is a constant. Specifically, if a trial of the experiment (as performed by you, or by a superior being) results in Y having value α, then the sample path of the random process that corresponds to this experimental outcome has value α for all t, and the DC value of the sample path is α, not E[X(t)]=E[Y], no matter how long you observe the (rather boring) sample path. In a parallel universe, the trial would result in Y=β and the sample path in that universe would have value β for all t. It is not easy to write mathematical specifications to exclude such trivialities from the class of stationary processes, and so this remains as an example of a stationary random process that is not ergodic.

(B) What is a continuous random sequence?

In X(s,t) when T is discrete and S is continuous , it is called continuous random sequence.

(C) Calculate the first moment of normal distribution.

$$E(X) = \int_{-\infty}^{\infty} x \frac{1}{\sigma\sqrt{2\pi}} \exp\left\{-\frac{(x-\mu)^2}{2\sigma^2}\right\} dx$$

First central moment is the mean : It is given by (mu)

(D) Give a practical example of (a) Poisson distribution (b) Uniform distribution

(a) The classical example of the Poisson distribution is the number of Prussian soldiers accidentally killed by horse-kick, due to being the first example of the Poisson distribution's application to a real-world large data set. Ten army corps were observed over 20 years, for a total of 200 observations, and 122 soldiers were killed by horse-kick over that time period. The question is how many deaths would be expected over a period of a year, which turns out to be excellently modeled by the Poisson distribution.

(b) There are lots of things. The serial number on a randomly selected one dollar bill. The number that comes up from the roll of a fair die. The first number picked for the lottery. The class rank of a randomly selected student (assuming no ties).

(E) For a random variable 'X' following the probability density function, $p(x)$, shown in figure 2, calculate the mean and the variance.

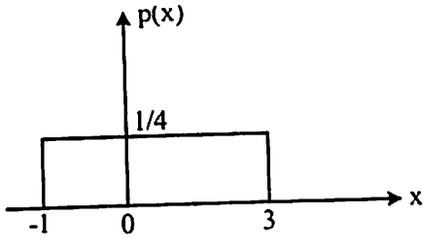


Figure 2: Probability distribution of RV X

Soln. Mean or average of any random variable is known as expected value of random variable X

$$Mean = \mu_X = E[X] = \int_{-\infty}^{\infty} xP_X(x)dx$$

$$= \int_{-1}^{3} x\frac{1}{4}dx = \frac{1}{4}\left[\frac{x^2}{2}\right]_1^3$$

$$= \frac{1}{4}\left[\frac{8}{2}\right] = 1$$

$$Variance = \sigma_x^2 = E[(X-\mu_X)] = \int_{-\infty}^{\infty}(x-\mu_X)^2 P_X(x)dx$$

$$= \int^{3}(x-1)^2\frac{dx}{4}$$

$$= \int_{-1}^{3}(x-1)^2\frac{dx}{4}$$

$$= \frac{1}{4}\int_{-1}^{3}(x^2+1-2x)dx$$

$$= \frac{1}{4}\left[\frac{x^3}{3}+x-\frac{2x^2}{2}\right]_{-1}^{3}$$

$$= \frac{4}{3}$$

SECTION - II

Q-4

1. If the event A and event B are independent events, then $P(A/B) =$ **$P(A)$**

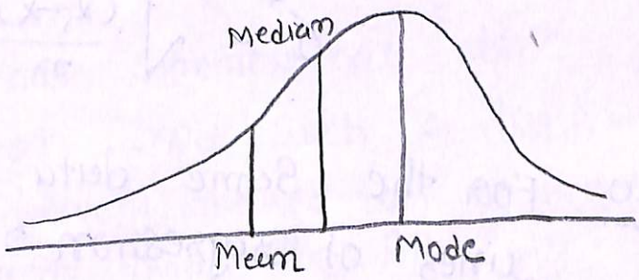
→ For Independent events

$$P(A \cap B) = P(A) \cdot P(B)$$

So, $$P(A/B) = \frac{P(A \cap B)}{P(A)} = \frac{P(A) \cdot P(B)}{P(B)} = P(A)$$

2. For a left skew distribution, how are mean, median mode related. Draw a left skewed distribution and write in one line

mean < median < mode



3. $F[E[X]] - F[-\infty] - F[+\infty] =$ **-0.5** where X is Continuous R.V. over $[-\infty, \infty]$

→ $F[E[X]] = 0.5$, $F[-\infty] = 0$, $F[\infty] = 1$

So, $F[E[X]] - F[-\infty] - F[\infty] = -0.5$

4. A negative correlation between two random variable X and Y mean that, with increase in value of X, Y value **decreases**

5. $F[E[X]] =$ **0.5** where X is the Continuous RV over $[-\infty, \infty]$

6. Median is called the positional average

7. If the correlation coefficient of X and Y is r then correlation coefficient of $aX+b$ and $hY+b$ is r

8. Write whether the statement is true or false: 57% of the data lie between mean $\pm$ quartile deviation.

→ True

9. Variance $[a]$ = 0 where a is the constant.

→ Since a is constant. $E[a] = a$

and $$\sigma = \sqrt{\frac{(x_i - \bar{x})^2}{n}} = 0$$

10. For the same data, why we get two different lines of regression?

→ For the data given, (x, y) coordinate the value of all coordinate of X-axis and Y-axis are different

generally regression line try to set when it get minimum square error from the given points.

- Regression Line of Y on X, try to minimize least square error of Y.
- Regression line of X on Y, try to minimize least square error of X.

So, we will have two different lines of regression of the same given data.

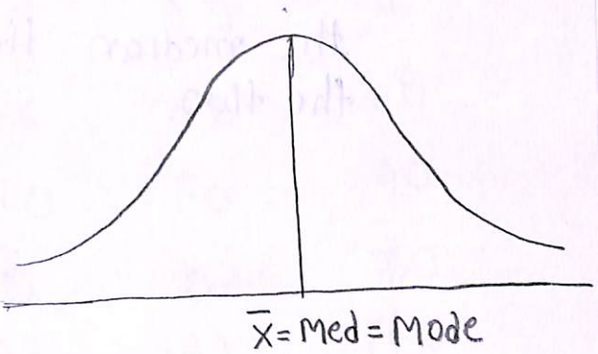
Q-5 [A]

Define the term.

(I) Symmetrical Distribution

→ It is clear from the diagram that in a symmetrical distribution the value of the mean, median and mode coincide.

→ The spread of the frequencies is the same on the both sides of the center point of the curve.



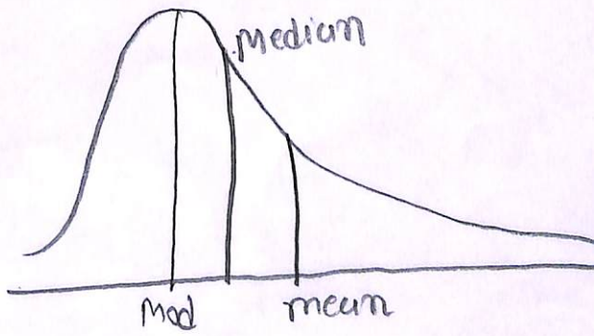
(2) Asymmetric distribution

→ A distribution which is not symmetrical is called a skewed distribution and such a distribution could either be positively skewed or negatively skewed as would be clear from the following diagram:

- Positively skewed distribution

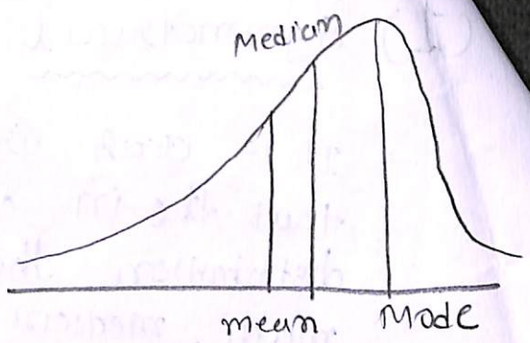
→ In the positively skewed distribution, the value of the mean is maximum and the mode is at least

→ The median lies between mode and mean



- Negatively skewed distribution

→ In the negatively skewed distribution the value of the mode is maximum and that of mean least - the median lies between the two.



Q-5 [B]

Calculate Arithmetic mean and Variance

$(m-125.5)/10$

Weight	m	f	d	fd	fd^2	c.f
81-90	85.5	2	-4	-8	32	2
91-100	95.5	5	-3	-15	45	7
101-110	105.5	13	-2	-26	52	20
111-120	115.5	20	-1	-20	20	40
121-130	125.5	30	0	0	0	70
131-140	135.5	49	1	49	49	119
141-150	145.5	37	2	74	148	156
151-160	155.5	29	3	87	261	185
161-170	165.5	11	4	44	176	196
171-180	175.5	3	5	15	75	199
181-190	185.5	1	6	6	36	200
		$N=200$		$\Sigma fd = 206$	$\Sigma fd^2 = 894$	

$$\bar{X} = A + \frac{\Sigma fd}{N} \times i$$

$$= 125.5 + \frac{206}{200} \times 10$$

$$= 125.5 + 10.3$$

$$\boxed{\bar{X} = 135.8}$$

$$\sigma = \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2} \times i = \sqrt{\frac{894}{200} - \left(\frac{206}{200}\right)^2} \times 10$$

$$= \sqrt{4.47 - 1.061} \times 10 = 1.846 \times 10 = 18.46$$

$$\boxed{\sigma^2 = 340.77}$$

Q-5 (B) [OR]

I. The annual rate of growth of an economy over the last five years were 1.5, 2.7, 3.0, 4.5 and 6.2 per cent respectively. What is the compound rate of growth per annum of the economy for the period?

Soln :-

Annual rate of growth	Growth relatives at the end of year (x)	log(x)
1.5	101.5	2.0064
2.7	102.7	2.0116
3.0	103.0	2.0128
4.5	104.5	2.0191
6.2	106.2	2.0261
		$\Sigma \log(x) = 10.076$

$$G.M = A.L\left(\frac{\Sigma(\log(x))}{N}\right)$$

$$= A.L\left(\frac{10.076}{5}\right)$$

$$= A.L\ (2.0152)$$

$$G.M = 103.5$$

Growth per annum is 3.5 %.

II. Calculate the median

Soln:-

Weight	f	c.f
409.5 - 419.5	14	14
419.5 - 429.5	20	34
429.5 - 439.5	42	76
439.5 - 449.5	54	130
449.5 - 459.5	45	175
459.5 - 469.5	18	193
469.5 - 479.5	7	200
	$N = 200$	

Med = size of $N/2$ th item

$= \frac{200}{2} = 100^{th}$ item

→ Median lies in the class 439.5 - 449.5

$$\text{Med.} = L + \frac{N/2 - c.f}{f} \times i$$

$L = 439.5$, $N/2 = 100$, $c.f = 76$, $f = 54$, $i = 10$

$$\text{Med} = 439.5 + \frac{100 - 75}{54} \times 10$$

$$= 439.5 + 4.44$$

$$\text{Med} = 443.94$$

Q-6 (A)

Compute the Coefficient of Correlation between X & Y.

X	Y	X·Y	X^2	Y^2
80	82	6560	6400	6724
45	56	2520	2025	3136
55	50	2750	3025	2500
56	48	2688	3136	2304
58	60	3480	3364	3600
60	62	3720	3600	3844
65	64	4160	4225	4096
68	65	4420	4624	4225
70	70	4900	4900	4900
75	74	5550	5625	5476
85	90	7650	7225	8100
717	721	48,398	48,149	48,905

$\bar{x} = 65.18$

$\bar{y} = 65.54$

$$r = \frac{n \cdot \Sigma x_i y_i - \Sigma x_i \Sigma y_i}{\sqrt{n \cdot \Sigma x_i^2 - (\Sigma x_i)^2}\ \sqrt{n \cdot \Sigma y_i^2 - (\Sigma y_i)^2}}$$

$$= \frac{15421}{\sqrt{15550}\ \sqrt{18114}}$$

$$\boxed{r = 0.9188}$$

Q-6 (B)

Compute the coefficient of correlation between X & Y & Regression lines

X	Y	XY	X^2	Y^2
4.7	4	18.8	22.09	16
8.2	8	65.6	67.24	64
12.4	12.5	155	153.76	156.25
15.8	16	252.8	249.64	256
20.7	20	414	428.49	400
24.9	25	622.5	620.01	625
31.9	31	988.9	1017.61	961
35	36	1260	1225	1296
39.1	40	1564	1528.81	1600
38.8	40	1552	1505.44	1600
231.5	232.5	6893.6	6818.09	6974.25

$\bar{X} = 23.15$

$\bar{y} = 23.25$

⇒ Regression line of X on y

$$a = \frac{n \cdot \Sigma x_i y_i - \Sigma x_i \Sigma y_i}{n \cdot \Sigma x_i^2 - (\Sigma y_i)^2}$$

$$= \frac{15112.25}{15686.25} = 0.9634$$

$$b = \bar{X} - a\bar{y} = 0.7507$$

⇒ $X = (0.9634)y + 0.7507$

⇒ X at $y = 45$

$r = 0.9982$

$X = 43.35 + 0.75$

$\boxed{X = 44.10}$

Q-6 [C]

Calculate the value of mode

X	f	II	III	IV	V	VI
15	8	20				
20	12		48			
25	36	71		56		
30	35		63		83	
35	28	46		81		99
40	18		27		55	
45	9					

Analysis table

Colm no	25	30	35
I	1		
II	1	1	
III		1	1
IV		1	1
V	1	1	
VI	1	1	1
	4	5	3

Corresponding to the maximum total 5,

Hence the modal value is 30

Exam No: _____

GANPAT UNIVERSITY

B. TECH.CSE (CBA/MA/BDA) SEM- IV REGULAR EXAMINATION–APRIL-JUNE 2018

2CSE402: Operating System

TIME: 3 HRS TOTAL MARKS: 60

SECTION-I

Q-1 Answer the following questions **10x1** **10**

1) A system call to create a child process is _____.
2) What do you mean by preemptive scheduling?
3) What is context switching? Why it is considered to be an overhead?
4) Which scheduler controls the degree of multiprogramming?
5) Define: Starvation.
6) What is the disadvantage of SJF scheduling algorithm? How HRRN scheduling algorithm improve it?
7) Suppose that process is in BLOCK state and waiting for some I/O services when service is completed, it goes to the _____ state.
8) What is Process Control Block?
9) _____ is called lightweight process.
10) Define: Critical section.

Q-2 Answer the following questions **2x5** **10**

(A) 1) Draw the process state transition diagram. **2**
2) Explain multilevel feedback queue scheduling algorithm. **3**

(B) 1) What are the difference between user-level threads and kernel-supported threads? **2**
2) What is message passing and why it is used? What do you mean by direct and indirect communication? **3**

OR

(B) 1) Distinguish between binary and counting semaphore. **2**
2) Discuss 3 types of job scheduler. Which kind of scheduler decides which of the ready queue process will be executed next? **3**

Q-3 Solve any two out of three **2x5** **10**

1) What is Readers-Writes Problem? Write the pseudo code of the Reader and Writer process using semaphore and explain in brief.
2) Write pseudo code of strict alternation and Peterson's solution to solve the critical section problem. Which of the three essential criteria are satisfied by both? Justify your answer.

3) Following table gives arrival time and expected run (burst) time of five processes. Draw Gantt chart. Find average turnaround time, average waiting time for following scheduling algorithm:
   a) Round robin (quantum = 1 sec)
   b) Shortest Job First
   c) Highest Response Ratio Next

Processes	Arrival Time	Burst Time
A	1	8
B	4	1
C	2	2
D	5	1
E	6	5

SECTION-II

Q-4 Answer the following questions **10x1** **10**

1) What is thrashing? Why does it occur?
2) If machine is a 32 bit machine with a page size of 4 KB, then find out the bits required for page number and page offset.
3) Define: fragmentation.
4) Why page sizes are always powers of 2?
5) What is interrupt?
6) Describe Belady's anomaly.
7) Justify the purpose of dirty bit.
8) What is the role of Memory-Management Unit (MMU)?
9) What is page fault?
10) Give the name of technique used for overcoming external fragmentation.

Q-5 Answer the following questions **2x5** **10**

(A) 1) Consider a system with n processes and a single resource R with 24 copies. Each process Pi requires 4 copies of R to complete its execution. What is maximum value of n to ensure a deadlock free operation? **2**

2) Write short note on Segmentation. **3**

(B) 1) Consider a system having a TLB. A time required to search a page from TLB is 10 nanoseconds and 100 nanoseconds to access memory. The hit ratio of TLB is 90-percent. So calculate the effective memory access time. **2**

2) Write a short note on DMA. **3**

OR

(B) 1) Given memory partition set up with current holes of 200KB, 600KB, 300KB, 400KB and 700KB (in order). How would each of best fit and worst fit algorithm place processes of 313KB, 517KB, 212KB and 526KB? **2**

2) Explain any two File Allocation Methods from the following: 3
(a) Contiguous Allocation (b) Linked Allocation (c) Indexed Allocation

olve any two out of three 2x5 10

1) How the logical address is converted to the physical address in paging mechanism in MMU? Justify it with an appropriate diagram and example. What is the disadvantage of simple paging? What are the solutions?
2) What is Deadlock? Explain the conditions that lead to deadlock. How deadlock can be prevented?
3) For the following page reference string:
7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1
Calculate the page faults applying the following Page Replacement Algorithms for a memory with three frames:
   a) Optimal
   b) LRU
   c) FIFO

END OF PAPER

Exam No: _____

GANPAT UNIVERSITY

B. TECH.CSE (CBA/MA/BDA) SEM- IV REGULAR EXAMINATION–APRIL-JUNE 2018

2CSE402: Operating System

TIME: 3 HRS | TOTAL MARKS: 60

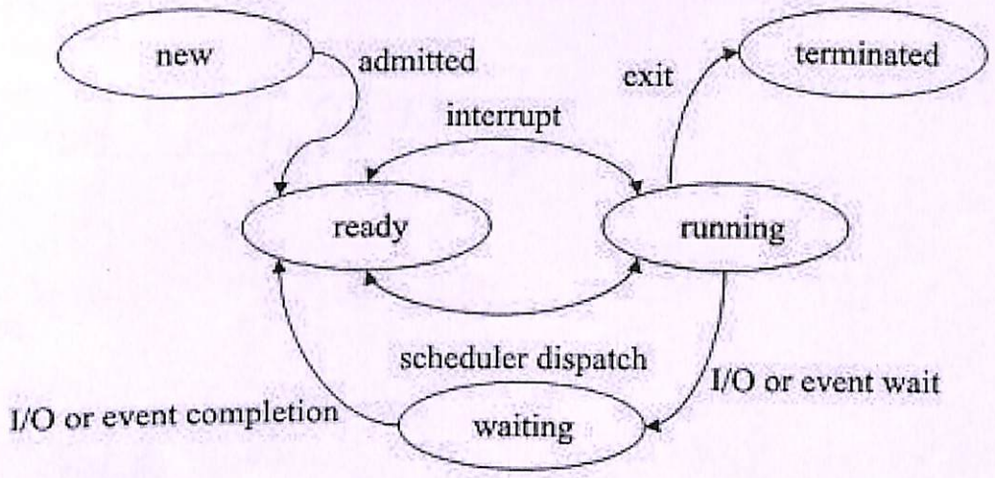
SECTION-I

Q-1 Answer the following questions **10x1 10**

1) fork()
2) At times it is necessary to run a certain task that has a higher priority before another task although it is running. Therefore, the running task is interrupted for some time and resumed later when the priority task has finished its execution. This is called preemptive scheduling.
3) A context switching is the switching of the CPU (central processing unit) from one process or thread to another. Context switching is overhead because it is cycles (time) that the processor is being used but no user code is executing, so no directly productive computing is getting done.
4) long term scheduler
5) Starvation is the name given to the indefinite postponement of a process because it requires some resource before it can run, but the resource, though available for allocation, is never allocated to this process.
6) SJF scheduling algorithm considers only burst time i.e. favors the shorter jobs. Hence starvation to longer jobs. HRRN scheduling algorithm gives weightage to both burst time and waiting time. So HRRN does not only favor shorter jobs but also limits the waiting time of longer jobs.
7) READY
8) A Process Control Block is a data structure maintained by the Operating System for every process. The PCB is identified by an integer process ID (PID). A PCB keeps all the information needed to keep track of a process.
9) thread
10) A critical section is a code segment that accesses shared variables and has to be executed as an atomic action.

Q-2 Answer the following questions **2x5 10**

(A) 1) Draw the process state transition diagram. **2**



2) No solution required 3

(B) 1) No solution required 2
2) No solution required 3

OR

(B) 1) Binary semaphores are binary, they can have two values only; one to represent that a process/thread is in the critical section(code that access the shared resource) and others should wait, the other indicating the critical section is free. On the other hand, counting semaphores take more than two values, they can have any value you want. The max value X they take allows X process/threads to access the shared resource simultaneously. 2

2) There are 3 types of job scheduler: short, term, medium term and long term. Explain them in brief. Short term scheduler decides which of the ready queue process will be executed next. 3

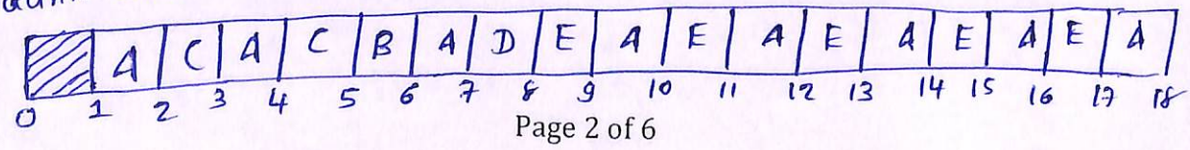
Q-3 Solve any two out of three **2x5** **10**

1) No solution required
2) No solution required
3) Draw the Gantt Charts:

Processes	Arrival Time	Burst Time
A	1	8
B	4	1
C	2	2
D	5	1
E	6	5

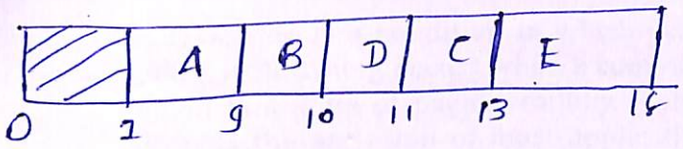
→ a) Round Robin :-

Gantt chart :-

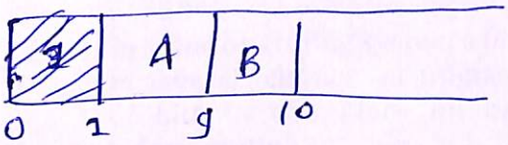


SJF :-

Gantt chart:



c) HRRN :-



At $t=1$, only one process (A)

At $t=9$, Response Ratio

$$RR = \frac{w+s}{s}$$

w - waiting time
S - service time

$$RR(B) = \frac{5+1}{1} = 6$$

$$RR(C) = \frac{7+2}{2} = 4.5$$

$$RR(D) = \frac{4+1}{1} = 5$$

$$RR(E) = \frac{3+5}{5} = 1.6$$

∴ So B is selected

Again at $t=10$, continue & select the proces.

Hint. ⇒ Compute C.T based on the Gantt chart then Find T.A.T = C.T. − A.T & W.T. = T.A.T − B.T. for each process & compute average of it.

SECTION-II

Answer the following questions **10x1 10**

1) A thrashing is a condition in which excessive paging operations are taking place. A thrashing occurs when a computer's virtual memory subsystem is in a constant state of paging, rapidly exchanging data in memory for data on disk, to the exclusion of most application-level processing. This causes the performance of the computer to degrade or collapse.
2) If machine is a 32 bit machine with a page size of 4 KB and page number p and page offset d then
   p + d = 32
   d = 12
   p = 20
3) In some operating system's file systems, a data file over a certain size is stored in several "chunks" or fragments rather than in a single contiguous sequence of bits in one place on the storage medium, a process that is called fragmentation.
4) It is most efficient to break the address into X page bits and Y offset bits, rather than perform arithmetic on the address to calculate the page number and offset. Because each bit position represents a power of 2, splitting an address between bits results in a page size that is a power of 2.
5) In system programming, an interrupt is a signal to the processor emitted by hardware or software indicating an event that needs immediate attention.
6) Belady's anomaly proves that it is possible to have more page faults when increasing the number of page frames while using the First in First out (FIFO) page replacement algorithm.
7) A dirty bit is a bit in memory switched on when an update is made to a page by computer hardware. When the dirty bit is switched on, the page has been modified and can be replaced in memory.
8) The role of Memory-Management Unit (MMU) is to map the logical address to physical address.
9) Page fault is a type of exception raised by computer hardware when a running program accesses a memory page that is not currently mapped by the memory management unit (MMU) into the virtual address space of a process.
10) Compaction

Q-5 Answer the following questions **2x5 10**

(A) 1) Consider a system with n processes and a single resource R with 24 copies. Each process Pi requires 4 copies of R to complete its execution. What is maximum value of n to ensure a deadlock free operation? **2**

Ans: n=7. Suppose there are 8 processes and each of them has 3 copies of R then it results in deadlock. So minimum value of n is 8 for possibility of deadlock. So to ensure deadlock free operation, the **maximum value of n = 7**

2) No solution required **3**

3) 1) Consider a system having a TLB. A time required to search a page from TLB is 10 nanoseconds and 100 nanoseconds to access memory. The hit ratio of TLB is 90-percent. So calculate the effective memory access time. **2**

Ans: 120 nanoseconds

c=10,m=100,x=0.9

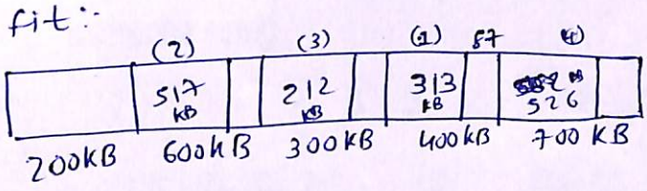
EMAT= x(c+m) + (1-x)(c+2m) = 0.9(10+100) + 0.1(10+200) =99+21 = 120

2) No solution required **3**

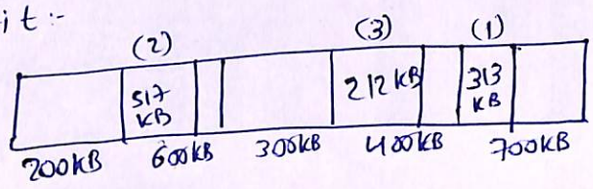
OR

(B) 1) Given memory partition set up with current holes of 200KB, 600KB, 300KB, 400KB and 700KB (in order). How would each of best fit and worst fit algorithm place processes of 313KB, 517KB, 212KB and 526KB? **2**

→ Best fit:-



→ Worst Fit:-



→ 526 kB - we cannot allocate.

2) No solution required **3**

Q-6 Solve any two out of three **2x5** **10**

1) No solution required
2) Mutual Exclusion, Hold & Wait, No preemption, Circular wait
3) For the following page reference string:
   7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1
   Calculate the page faults applying the following Page Replacement Algorithms for a memory with three frames:
   a) Optimal
   b) LRU
   c) FIFO

→ Consider the 3 frames are given.
Solution on next page.

a) Optimal: No. of page faults: 9

reference string

7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
7	7	7	2		2		2		2				2				7		
	0	0	0		0		4		0				0				0		
		1	1		3		3		3				1				1		

page frames

b) LRU: No. of page faults: 12

reference string

7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
7	7	7	2		2		4	4	4	0			1		1		1		
	0	0	0		0		0	0	3	3			3		0		0		
		1	1		3		3	2	2	2			2		2		7		

page frames

c) FIFO: No. of page faults: 15

reference string

7	0	1	2	0	3	0	4	2	3	0	3	2	1	2	0	1	7	0	1
7	7	7	2		2		4	4	4	0			0				7		
	0	0	0		3		3	2	2	2			1				1		
		1	1		1		0	0	3	3			3				2		

page frames