Chhatrapati Shahu Ji Maharaj
University, Kanpur

Answer Script Details
Barcode 11535436

Roll No. 24079000007
Total Mark 60/75.00

Exam M.SC-III_ODD_EXAM_NOV_2025
Subject B060902T - Optimization Techniques

Question wise Mark Summary

Q.No	Mark	Q.No	Mark	Q.No	Mark	Q.No	Mark
1A	4/5	6	0/15				
1B	4/5	7	12/15				
1C	3/5	8	0/15				
1D	4/5	9	0/15				
1E	4/5						
1F	4/5						
1G	4/5						
1H	5/5						
1I	3/5						
2	0/15						
3	0/15						
4A	3/3						
4B	2/3						
4C	2/3						
4D	3/3						
4E	3/3						
5	0/15						

Chhatrapati Shahu Ji Maharaj University
Kanpur, Uttar Pradesh

PART-I

Date of Exam: 4/12/25 Sem: 3 Room No. 9

Subject: Statistics (Sem 3)

Name: Divya Dwivedi

Roll No. 2 4 0 7 9 0 0 0 0 7

Signature of Candidate: Divya

Signature of Invigilator

OMR Facsimile

PART-II

MARKS OBTAINED

Q	1	2	3	4	5	6	7	8	9	10
(a)										
(b)										
(c)										
(d)										
(e)										
(f)										
(g)										
(h)										
(i)										
(j)										
Total										

Total Marks in Figures | Max. Marks

Total Marks in Words

B 0 6 0 9 0 2 T

Paper Code

Signature of Evaluator

PART-III

Course: MSC

Session: 2025-26 Year/Semester: 3

Subject: Optimization techniques (Statistics)

Paper Code: B 0 6 0 9 0 2 T

Exam Date: 0 4 1 2 2 0 2 5

Name of Candidate: DIVYA DWIVEDI

Father's Name: SANTRAM DWIVEDI

महाविद्यालय का कोड College Code: K N 0 3

परीक्षा केन्द्र का कोड Exam Centre Code: K N 0 3

परीक्षा का प्रकार Type of Exam: Regular (filled) / Ex Student / Private / Back paper Exam

ANSWER BOOKLET NO.

11535436

B 0 6 0 9 0 2 T

Paper Code

PART-IV

Enrollment Number: C S J M A 2 4 0 0 0 0 0 3 8 2 1

परीक्षार्थी अनुक्रमांक संख्या Candidate's Roll Number: 2 4 0 7 9 0 0 0 0 7

पेपर कोड Paper Code: B 0 6 0 9 0 2 T

Signature of Candidate: Divya

Signature of Invigilator

C.S Facsimile

OMR Facsimile

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-I

1. Read the instructions carefully given on the answer script and admit card.
2. Write Date of Exam, Shift, Paper Code & Name of Subject Correctly.
3. Write Name & Roll No. Correctly.
4. Write Semester & Branch Correctly.

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-III

1. Use blue or black ball point pen for writing alphabets & numerals in ☐ Boxes.
2. Carefully study the example before you start marking.
3. As shown in the example below blacken the circles completely.

Correct method: ① ● ③ ④

Incorrect method: ✓ ✗ ● ⊘

4. Make no Stray marks on this sheet.
5. **DO NOT WRITE OR MARK ON THE BAR CODE.**

परीक्षार्थी के लिए निर्देश

1. प्रवेश पत्र एवं उत्तर पुस्तिका पर दिये गये निर्देशों को ध्यान से पढ़ें।
2. कवर पृष्ठ के दूसरी तरफ कुछ न लिखें।
3. उत्तर पुस्तिका के पृष्ठों पर दोनों तरफ लिखें।
4. प्रश्न पत्र पर अपने अनुक्रमांक के अतिरिक्त कुछ न लिखें।
5. प्रश्न पत्र कोड एवं प्रश्न पत्र कोड सावधानी पूर्वक लिखें।
6. अपनी स्थिति स्पष्ट लिखें।
7. उत्तर पुस्तिका के पृष्ठों की संख्या देखें। अगर उत्तर पुस्तिका में पृष्ठ (1–24) से कम है या फटे हुए है, तो परीक्षा शुरू होने के पूर्व दूसरी उत्तर पुस्तिका ले लें।
8. प्रश्नपत्र को देख, यदि प्रश्नपत्र के विषय कोड, विषय का नाम तथा प्रश्न में कोई त्रुटि है तो उसके परीक्षा शुरू होने के 30 मिनट के अन्दर कक्ष निरीक्षक को तत्काल सूचित करें, उसके बाद विश्वविद्यालय द्वारा कोई कार्यवाही नहीं की जायेगी।
9. प्रश्नों के उत्तर लिखने के लिये पेंसिल का प्रयोग न करें।
10. B कोपी या अतिरिक्त पाक नहीं दिया जायेगा।

IN ORDER TO AVOID UFM (UNFAIR MEANS) :

1. The Roll No. and Answer Book no. found elsewhere or any other symbol found in the answer book will be treated as unfair means.
2. Any tempering of Bar Code and Booklet no shall be treated as Unfair Means.
3. Do Not bring the materials like slip of paper/mobile/digital diaries/ study material/ revision notes in examination hall. Possession of the mobiles/ digital diaries/ electronic watch and any other electronic gadget except memory less scientific calculator shall be considered as UFM case.
4. Do not keep or paste currency note in answer script it shall be consider as UFM.

INSTRUCTIONS TO THE CANDIDATE

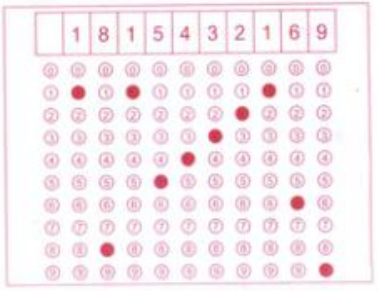
1. Read the instructions carefully given on the Question Paper, Admit Card & Answer Script.
2. Do not write anything on back side of the cover page.
3. Write on both sides of pages of answer book.
4. Do not write anything on question paper except Roll Number.
5. Write Paper Code & Question Paper Id carefully.
6. CHECK the number of pages (1-32) or any other kind of damage in your answer script, if found than change the answer script immediately before the commencement of examination.
7. CHECK the Question Paper for any kind of discrepancy e.g. Subject Code, Subject Name and Question of the Question Paper during first THIRTY MINUTES of the commencement of the exam, so that it can be corrected in TIME. After that no corrections shall be entertained by the university.
8. Do not use pencil for answering the question.
9. Write status correctly e.g. those appearing in carry over papers should fill in status as Carry Over. Those appearing as Ex-Students should fill in status as ex.
10. No supplementary answer book & graph paper will be provided.

अनुचित साधन से बचने हेतु:

1. उत्तर पुस्तिका के निर्दिष्ट स्थान को छोड़कर अनुक्रमांक एवं उत्तरपुस्तिका का क्रमांक कहीं और न लिखे तथा कोई भी चिन्ह न बनायें क्योंकि यह अनुचित साधन प्रयोग की परिधि में आता है।
2. उत्तर पुस्तिका के बारकोड अथवा उत्तर पुस्तिका संख्या पर छेड़ करने पर अनुचित साधन प्रयोग माना जायेगा।
3. परीक्षा कक्ष में निम्न वस्तुएं साथ न लायें, जैसे लिखे हुए कागज के टुकड़े, मोबाईल, डिजिटल डायरी, कोपी, पुस्तक यह सभी वस्तुएं जो अनुचित साधन के अन्तर्गत आती है। केवल संबंधित प्रश्नपत्र में ही मेमोरी लैस साइंटिफिक कैलकुलेटर ले जाने की अनुमन्यता होगी।
4. उत्तर पुस्तिकाओं में रूमाले न रखें न ही उत्तर पुस्तिका में बिन्दकायें। ऐसा करना अनुचित साधन प्रयोग की परिधि में आता है।

INSTRUCTIONS TO THE CANDIDATE FOR FILLING PART-IV

1. Use blue or black ball point pen for writing alphabets & numberals in ☐ Boxes.
2. Use blue or black ball point pen for filling the circles.



Note - If your Roll No. is of 10 digits. Please leave first three columns

Paper Code B 0 6 0 9 0 2 T 01

SHORT ANSWER TYPE QUESTIONS

1(A)

Hungarian Method is the method in assignment problem used to allocate equal number of resources to the equal number of activities. equal (n) persons assign to (n) jobs.

→ Steps involved in solving an assignment problem using Hungarian Method —

- Select the lowest value from the row and subtract it.
- Select the lowest value from the column and subtract it.
- Draw minimum lines in a way to cover all zeros.
- If lines = n, we get optimal solution
- If lines < n then again do similar steps until we get optimal solution.

(B) Sequencing problem is used to allocate the jobs in a sequence way in order to minimize the time lapse between the initial and final job and to maximize profit.

→ Objective of sequencing problem is :

- to minimize the time.
- No over work for men as well as on machines.
- No underutilisation.

~~Product~~

- Reduce ideal time.
- Correct way of using time and minimizing cost.
- Minimum wait of the patients to get their report.

By sequencing the job we utilise time and machines in a better way

(c) Principal of Optimality in Dynamic programming —

Dynamic programming is the method to solve Overlaping problems by breaking down into subproblems and solving them at once.

principal of optimality — principal of Optimality is the property of initials and decision making in which the resulting decision is taken by optimal and from on the basis of initials.

The features of it -

- Optimal structure
- Recursive model
- Overlapping subproblems.
- Multipurpose decision process.

It uses for —

Knapsack Problem
Inventory Methods

(D) PERT

Problem Evaluation Review technique is the probabilistic activity time

- CPM –

Critical Path Method is the deterministic activity time.

- PERT is used for R & D projects.

whereas,

- CPM is used for manufacturing, building.

- PERT focuses on Time
- CPM focuses both on time as well as on cost.

→ The main objectives of PERT and

- CPM is network scheduling. by

identifying the objective and by

constructing Network diagram.

(c) Convex and concave functions—

In non linear programming, the objective functions and constrains are non linear so they use convex and concave function this is hard as compare to the linear programming.
convexity plays major role in non linear programming.

(d) Replacement Problem—

Replacement Problem is the technique to identify the optimal time where the product requires maintaince.

In companies, by putting all the works together machines using more efficiency and gives minimum result by replacing it. It starts to give maximum result.

Replacement means Replacement of a person, machine etc.

Two methods Per of Replacement

- First one is, Replacement Of an item when the thing Is deteriorated with time.
- Replacement of fully destroyed item. Called complete Replacement like bulb, tubelights.

Example — An companies after using many times machine starts to give less efficient result by Replacing their parts it start to give efficient fuley Result.

- Complete replacement Examples are Bulb, tubelights.

(H)

(G) Inventory refers to the collections of goods for future demand.

Inventory level

- Maintaining an optimum inventory level is important to avoid wastage of money and items.

Company used inventory to minimize the inventory cost and fullfill their future demands.

- Inventory level helps to ~~not~~ decided that ~~the~~ there should be no overstock and not stock off.

- Continous supply.
- Provide Customer satisfaction.
- Smooth supply
- No overstock
- Minimizing cost.

(H) ~~Game Theory~~

Game is a task in which two or more competitors involved and

and each of them wants to win.

Game theory is a decesion making ability under the conflict and competitive situation.

In Game, competitors are referried as players.

In Game, competitors can be ~~both~~ anyone even Organizations also.

In Game theory Player uses it stratigies to win their game.

~~components of Game~~—

~~Strategy~~— strategy is a type of technique player used to win their games.

There are two types of teel strategies—

~~Pure strategy~~— when a player choises same time a strategy its called Pure strategy

in probability is 1

Mixed strategy — when a player use different strategies every round it consired as considered as mixed strategy.

Players — Players are termed as competitors who usually play the game.

Saddle point — Saddle point is a point in which value of game is equal.

In a game on minimising the row and find Rmax (maximum value of row after minimising.

and in colomn on finding maximum value of colmn and obtaining minimum value of it Cmin

When Rmax = Cmin it is considered as saddle point which is equal to the value of game.

1. Simulation —

Simulation is used to imitate the working in real life using mathematical and computer method when it is is too complicated to solve.

There are two types of Simulation.

- **Hand Simulation —** In hand simulation work can be done manually using numbers and tables

- **Computer Simulation —**

In computer simulation, it is done by programming and software language

Ex — Monte Carlo Simulation.

Simulation is applicable on-

- Waiting line
- Traffic networks
- Inventory problems.

But simulation requires.

- Expertise to solve
- long simulation require more money i.e. it is costly
- It does not give optimal solution
- It give approximation.

LONG ANSWER TYPE QUESTIONS-

(4)

PERT-

Problem evaluation Review technique is the probabilistic activity time

Critical Path Method is the deterministic activity time.

commonly used terms —

- Event — It is the starting (beginning) and ending of the activity.
- Activity — Activity is the procedure or a task done by the persons or any one whom could the task given.
- Dummy Activity — where activity has no effect which is zero it considered as dummy activity.

- **Path** — Path is the way through which the experiment or any event done.
- **Critical Path** — Critical Path is considered as the longest Path.

There are several steps required as these terms for Network scheduling —

- Identify the objectives
- Construct Network diagram
- Forward Pass — It is the earlies time
- Backward Pass — It is the latest time
- Obtain slackness
- evaluate the Critical Path.

There is also time estimation of PERT in which these term play specific role —

Optimistic (a)
Most likely (m)
Pessimistic (b)

$$= \frac{a + 4m + b}{6}$$

Variance –

$$\sigma^2 = \left(\frac{b-a}{6}\right)^2$$

Section C

7 – ~~Economic~~ Order Quantity

Inventory level method helps to fulfill demand by goods stock.

EOQ is the method to obtain goods in order to fulfill future demands.

~~An a~~ ...npany chooses optimal inventory in order to minimize

their cost and fall their future demands and minimising the shortage and shortage and storage cost.

An EOQ model demand is known and certain.

$$EOQ = \sqrt{\frac{2AOc}{Cc\,pupa}}$$

Where -

A = Annual demand
Oc = Ordering cost
Cc = Critical cost per unit per annum

WKT,

$$TOC = TCC$$

$$\frac{A \cdot Oc}{EOQ} = \frac{EOQ}{2} Cc\,pupa$$

$$\frac{2A \cdot Oc}{Cc \cdot pupa} = (EOQ)^2$$

$$EOQ = \sqrt{\frac{2 \cdot A \cdot Oc}{Cc\,pupa}}.$$

$$EOQ = \sqrt{\frac{2DC}{H}}$$

D = demand
H = Handling cost.

EOQ model introduced by FN Harris in 1975

Assumptions –

An EOQ model

Cost is certain.

Orders are known
monitoring required.

No lead Time.

Significance

Because it involves inventory method –

Supply should be continuous

No Overstock

No stock off

Customer satisfaction

In Economic Order quantity the demand is certain and known suppose a shopkeeper sells charger of

EOQ = 500 units /month

and its Review Order is = 200 units

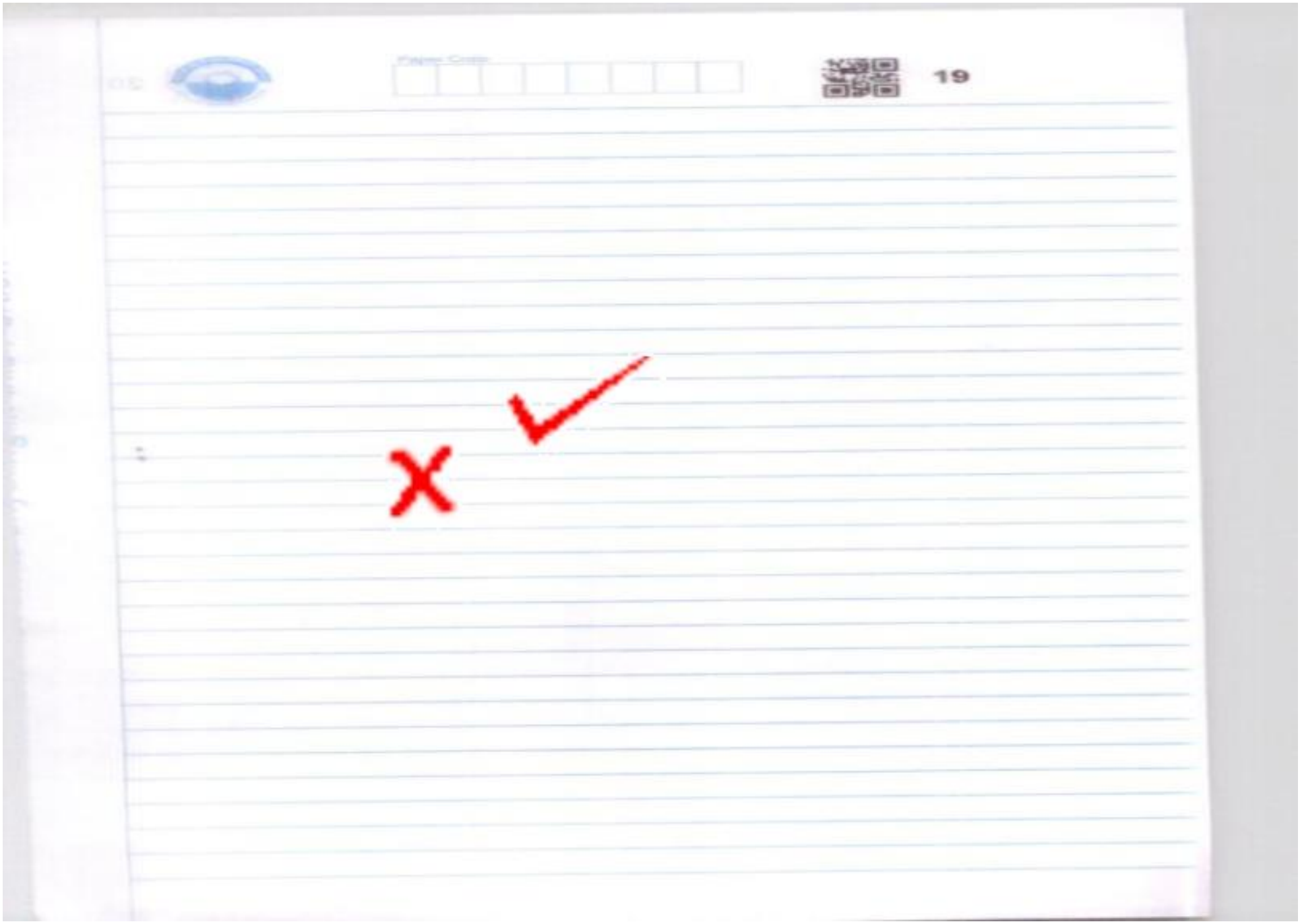
If shopkeeper sells i.e. 200 units its Review Order than it again fullfill his stock.

So complete monitoring Required

- EOQ model is usually used for costly goods.
- EOQ involves Q system. (Order ranking system)

Limitations —

- Seasonality
- Custor satisfaction.
- & keep monitored always
- Inventory done in a clean way to
- avoid stock off and over stock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24

Competitors

referred
to
reffered

$TOC = TCC$

$\frac{D}{EOQ} \times OC = \frac{EOQ}{2} \times C_{CPU}$