SET B
End Term Exam-IBM 311 (Autumn 2023)

Duration: From 10 am to 1 pm. Maximum Marks: 74.

Name:	
Subject Name:	
Subject Code:	
Serial number (assigned for this course):	
Enrollment No.:	
Date:	

Signature of the Student Signature of the Invigilator

Standard normal table is provided at the end of the question paper.

All questions carry 1 mark and has one third negative marking. Unanswered questions will not be marked.

Your answers should be marked in response sheet (backside of this page).

Question paper will be **collected** at the end of the exam.

Right side margin of the question paper can be used for rough work. Do not write/mark anything on the Standard Normal Table.

Examiner's Signature

Response Sheet

Serial Number (assigned for this course)**:** **Question Paper Set:**

Fill in the correct option for each question.

Section 1

Q. No.	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d
11	a	b	c	d
12	a	b	c	d
13	a	b	c	d
14	a	b	c	d
15	a	b	c	d
16	a	b	c	d
17	a	b	c	d
18	a	b	c	d
19	a	b	c	d
20	a	b	c	d
21	a	b	c	d
22	a	b	c	d
23	a	b	c	d
24	a	b	c	d
25	a	b	c	d
26	a	b	c	d
27	a	b	c	d
28	a	b	c	d
29	a	b	c	d
30	a	b	c	d
31	a	b	c	d
32	a	b	c	d
33	a	b	c	d

Section 1

Q. No.				
34	a	b	c	d
35	a	b	c	d
36	a	b	c	d
37	a	b	c	d
38	a	b	c	d
39	a	b	c	d
40	a	b	c	d
41	a	b	c	d
42	a	b	c	d
43	a	b	c	d
44	a	b	c	d
45	a	b	c	d
46	a	b	c	d
47	a	b	c	d
48	a	b	c	d
49	a	b	c	d

Section 2

Q. No	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d

Section 3

Q. No	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d

Section4

Q. No.	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d

Section 5

Q. No.	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d

Section 6

Q. No.	Options			
1	a	b	c	d
2	a	b	c	d
3	a	b	c	d
4	a	b	c	d
5	a	b	c	d
6	a	b	c	d
7	a	b	c	d

Section 1: General

1. Which of the following is not the correct expansion of the acronym:
   a) CRP: Capacity Requirement Planning
   b) MRP: Material Requirement Planning
   c) ERP: Enterprise Resource Procurement
   d) EOQ: Economic Order Quantity

2. Which of the following is the last stage of planning before production starts:
   a) CRP b) MRP c) APP d) Scheduling

3. Which of the following statements is correct:
   a) Slack rule is the optimal rule for sequencing
   b) SPT will always yield the lowest mean completion time
   c) DDATE does not yield the minimum tardiness.
   d) FIFO is the optimial rule for sequencing

4. What is the correct hierarchy of the planning activities in descending order of planning horizon:

a) Capacity Expansion, Aggregate Production Planning, Capacity Requirement Planning, Scheduling
b) Aggregate Production Planning, Capacity Expansion, Capacity Requirement Planning, Scheduling
c) Capacity Requirement Planning, Capacity Expansion, Aggregate Production Planning, Scheduling
d) Scheduling, Capacity Expansion, Aggregate Production Planning, Capacity Requirement Planning,

5. Item master file is in input to the Capacity Requirement Planning?

a) True b) False

6. Load profile is an output of the Material Requirement Planning?

a) True b) False

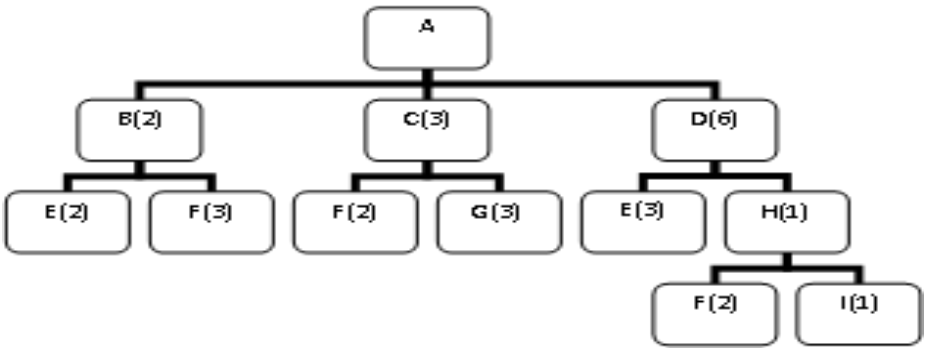
7. Which of the following statement is incorrect:

a) Efficiency and utilization are the same thing.
b) Efficiency is the ratio of output and input.
c) Scheduling aims to maximize the utilization.
d) Load leveling is done to even out the utilization.

8. POQ in MRP stands for

a) Periodic Order Quantity b) Production Order Quantity c) Period outstanding Quantity d) Perfect Order Quantity

9. The number of I's required for each A is



a. 1.
b. 2.
c. 6.
d. 12.

10. The _____ is a lot sizing technique that orders for multiple demand periods is referred to as

a. Lot-for-lot (L4L)
b. Periodic order quantity (POQ)
c. Economic order quantity(EOQ)
d. Multiple order quantity (MOQ)

11. Which of the following statements are not true about variation in business processes:

a) Variation in demand is structural
b) Common cause variation is said to be prevalent when an attributable cause can be identified.
c) Random variation and common cause variation refer to same phenomena.
d) Special cause variation is same as Assignable cause variation.

12. The scheduling rule that minimizes the makespan time for a set of jobs that must be processed through a two-step system where every job follows the same sequence through the two processes is

a. the shortest processing time
b. Johnson's Rule.
c. the assignment method.
d. the minimal slack rule.

13. Which of the following is an output of MRP

a) Master production schedule
b) Item master file
c) Product structure file
d) Planned order releases

14. Which of the following topics related to O&SCM was not covered in the course in detail:

a. MRP
b. SPC
c. Production Planning
d. QFD

15. BWE manifests as distortions in _____of the demand signal as it propagates upstream:
a) Amplitude
b) Phase Angle
c) Both
d) None

16. Which of the following statements is incorrect?
a) Red bead experiment demonstrates importance of quality intervention by top level management.
b) Funnel experiment relates with the flow of jobs on the shop floor.
c) Leverage principle applies to the Quality Costs.
d) Pareto effect can be seen in

17. Which of the following topics was not covered in the course:
a) Production Flow Analysis
b) Material Requirement Planning
c) Johnson's algorithm
d) Generalized Linear Programming

18. Which of the following is not true:
a) Quality is inversely proportional to variability
b) Quality can be expressed as the ratio of Expectation and Performance
c) Quality costs more than pay for themselves
d) Quality has various dimensions.

19. Which of the following statement is correct?
i) The four primary functional areas of a firm are marketing, finance, operations, and legal.
ii) Operations management designs, operates, and improves marketing systems.
iii) An operations manager benefits from an integrated view of business organizations.
iv) The systematic analysis of work methods is known as operations research.
a) Option (1) and Option (2) only
b) Option (2) and Option (3) only
c) Option (3) only
d) Option (2) and Option (3) only

20. A measurement has a mean value of 0.5 meters with a standard deviation of 0.002 meters. If sample of size 5 are drawn from this population, what is the probability that the sample mean will be greater than 0.0501 m?
a) Approximately 23%
b) Approximately 3%
c) Approximately 13%
d) Approximately 33%

21. A measurement has a mean value of 0.5 meters with a standard deviation of 0.002 meters. If sample of size 5 are drawn from this population, 95% of the means of these samples are expected to be in the interval:
a) 0.4961 to 0.5039
b) 0.4961 to 0.6039

c) 0.3961 to 0.6039
d) 0.3961 to 0.5039

22. The _____ is a lot sizing technique that orders for multiple demand periods is referred to as
e. Lot-for-lot (L4L)
f. Periodic order quantity (POQ)
g. Economic order quantity(EOQ)
h. Multiple order quantity (MOQ)

23. Which of the following statements are not true about variation in business processes:
e) Variation in demand is structural
f) Common cause variation is said to be prevalent when an attributable cause can be identified.
g) Random variation and common cause variation refer to same phenomena.
h) Special cause variation is same as Assignable cause variation.

24. _____failure costs include scrap, rework, and downtime
a) External
b) Internal
c) Process
d) System

25. Which of the following is not quantitative technique for quality management:
a) Acceptance Sampling
b) Designed Experiments
c) ISO
d) Statistical Process Control

26. Which of the following statements describing characteristic of a control chart are false:
a) The centerline is determined by using special cause variations
b) The upper and lower control limits are based on special cause variation
c) The Centerline is determined by using the target value
d) All the above.

27. A value below the lower control limit on R chart is i) Statistically out of control and ii) non-desirable
a) Both i) and ii) are correct
b) Only i) is correct
c) Only ii) is correct
d) None of i) and ii) are correct

28. Which of the following expressions must always be correct for a process which is capable and is in control?
a) Tolerance> Process Variability > Control Limits
b) Process Variability > Tolerance > Control Limits
c) Tolerance> Control limits > Process Variability
d) Process Variability > Control Limits > Tolerance

e) Process Variability < Tolerance < Control Limits

29. 6 sigma in its popular sense (allowing 1.5sigma movement of mean) implies _____defects per million.
a) 3.4
b) 2700
c) .002
d) 27000

30. 6 sigma in its true sense (fixed mean, with deviation of 6 sigma on either side) implies _____defects per million.
a) 3.4
b) 2700
c) .002
d) 27000

31. 6 sigma such that deviation on each side of fixed mean is 3 sigma implies_____defects per million.
a) 3.4
b) 2700
c) .002
d) 27000

32. For a process which is in control and has the control limits as 3 sigma from the mean value, after how many samples on an average can the organization expect a false alarm from the control chart, e.g., a sample mean plotting outside the 3 sigma control limits?
a) 370
b) 270
c) 290
d) 390

33. For a process which is in control and has the control limits such that probability of getting a sample mean outside the control limits on one side of the chart is .001. After how many samples on an average can the organization expect a false alarm from the control chart, e.g., a sample mean plotting outside the control limits?
a) 500
b) 400
c) 370
d) 300

34. The mean contents of coffee cans filled on a particular production line are being studied. Standards specify that the mean contents must be 16 units, and from past experience it is known that the standard deviation of the can contents is 0.1 units. A random sample of nine cans is to be used and the control limits on the control chart set with a probability of 0.0025 on one side of the centre line. If the true mean of the process has shifted from 16 to 16.1 units, what is the probability that control chart will not detect this shift? The decision rule for detection is any sample mean falling outside the control limits.
a) 0.1492
b) 0.2492

c) 0.0492
d) 0.3492

35. A phantom bill of material is used
a. to group small, loose parts together.
b. when the product is manufactured in major subassemblies.
c. for subassemblies that are immediately consumed in the next stage of production.
d. when due dates have not been calculated.

36. The extent to which the firm will produce the inputs and control the outputs of each stage of the production process is known as:
a) vertical integration b) process flexibility c) process planning d) capital intensity.

37. Which of the following statements are correct:
i) Quality and Lean are complimentary set of ideas.
ii) Quality is directly proportional to the level of inventory.
iii) Inventory and Quality are contrasting set of ideas.
iv) Inventory and lean are contrasting set of ideas.

a) i only b) i, ii and iii c) i, ii, iii & iv d) i, ii, & iv e) ii only

38. The scheduling rule that minimizes the makespan time for a set of jobs that must be processed through a two-step system where every job follows the same sequence through the two processes is
e. the shortest processing time
f. Johnson's Rule.
g. the assignment method.
h. the minimal slack rule.

39. Which of the following is an output of MRP
a) Master production schedule
b) Item master file
c) Product structure file
d) Planned order releases

40. Which of the following statements about Red Bead Experiment is not true:
a) Developed by Deming
b) Systemic variability can be corrected by worker efforts.
c) Variability in the underlying process can led to a flawed system of short term incentives/penalties to employees
d) Systemic variability can be corrected by the intervention from the management

41. Which of the following statements about the Funnel experiment are not true:
a) Process tempering is a desirable thing.
b) System of profound knowledge should be built around the process.
c) It demonstrates the oscillations in the process from one undesirable state to another.
d) It demonstrates the natural variability present in all processes.

42. The underlying distribution for c-chart is
a. Poisson
b. Uniform
c. Normal
d. Binomial

43. The underlying distribution for p-chart is
a. Poisson
b. Uniform
c. Normal
d. Binomial

44. Which of the following topics related to O&SCM was not covered in the course in detail:
e. MRP
f. SPC
g. Production Planning
h. QFD

45. Fundamental problem of O&SCM is
a) Demand and supply are not collocated
b) Demand and supply are coincidental in time
c) Demand and supply are not coincidental in time
d) Demand and supply are not relevant

i) All of the above
ii) a) & c)
iii) b) & d)
iv) c) & d)

46. Generally, which of the following O&SC processes add the highest value
a) Marketing and Branding
b) Manufacturing
c) Design
d) Assembly

i) a and b ii) c and a iii) d iv) b

47. When we incorrectly label a forecast in control while it is out of control it is called as Type II error.
a) True
b) False

48. Which of the following statements is not correct:
a) Tracking signal is used to monitor forecasts
b) Control chart is used for monitoring of forecasts
c) Upper and lower limits on the control chart are fixed numbers and not multiples of standard deviation of the error.
d) Upper and lower limits on the tracking signal chart are fixed numbers and not multiples of its standard deviation.

49. When we incorrectly label a forecast out of control while it is actually in control, it is called as type II error.

a) True
b) False

Section 2: Sequencing 1

Job	Process 1	Process 2
A	12	9
B	8	11
C	7	6
D	10	5
E	5	8

The following set of jobs must be processed serially through a two-step system. If Johnson's Rule is used to sequence the jobs

1. Then the order in which the jobs would be performed is
   b. E-B-A-C-D
   c. C-B-E-D-A
   d. E-B-D-A-C
   e. D-E-B-A-C

2. then the makespan time (in hours) for all jobs is
   a. 47 hours.
   b. 53 hours.
   c. 90 hours.
   d. 95 hours.

3.then Job C would start processing on operation 2 at
   a. hour 13.
   b. hour 34.
   c. hour 47**.**
   d. hour 53

4Then Job A would complete processing on operation 2 at
   a. hour 21.
   b. hour 34.
   c. hour 38.
   d. hour 47.

Section 3: MRP

ITEM: C Lot Size: POQ LT: 2	Period							
	1	2	3	4	5	6	7	8
Gross Requirements	70	90	150	150	180	290	120	150
Schedule Receipts		200						
Project on Hand 100								
Net Requirements								

Planned Order Receipts								
Planned Order Releases								

Each order cost $500 and the holding cost is $0.75 per item per period

Q1 The periodic order quantity is

a. 3 periods of requirements
b. 2 periods of requirements
c. 1 period of requirements
d. 0 period of requirements

Q2 the planned order release for period 1 is

a. 270.
b. 290.
c. 340.
d. 560.

Q3 The planned order release for period 4 is

a. 270.
b. 290.
c. 340.
d. 560.

Q4 The projected on hand at the end of period 7 is

a. 330.
b. 270.
c. 150
d. 140.

Section 4: Scheduling

	Machine			
Product	A	B	C	D
1	8	9	6	6
2	5	3	17	5
3	13	9	9	8
4	13	18	5	8

Four products (1, 2, 3, and 4) must be processed on one of four machines (A, B, C, and D). The times required in minutes for each product on each machine are shown below.

1. If management wishes to assign products to machines so that the total time to complete all the products is minimized, then Product 1 is assigned to

    a. machine A.
    b. machine B.
    c. machine C.
    d. machine D.

2. If management wishes to assign products to machines so that the total time to complete all the products is minimized, then Product 3 is assigned to

a. machine A.
b. machine B.
c. machine C.
d. machine D.

3. If management wishes to assign products to machines so that the total time to complete all the products is minimized, then Product 4 is assigned to
   a. machine A.
   b. machine B.
   c. machine C.
   d. machine D.

4. If management assigns products to machines so that the total time to complete all jobs is minimized, then the time to complete Product 1 is
   a. 8 minutes.
   b. 9 minutes.
   c. 16 minutes.
   d. 12 minutes

5. The minimum time required to complete all the products is
   a. 29 minutes.
   b. 27 minutes.
   c. 24 minutes.
   d. 36 minutes.

Section 5 Sequencing 2

Job	Processing Time (days)	Due Date
A	8	12
B	6	15
C	11	17
D	5	10
E	3	8

1. If these jobs are sequenced according to the DDATE rule then the mean completion time (in days) for all jobs is (assume zero for today's date)
   a. 16.4 days.
   b. 22.6 days.
   c. 28.7 days.
   d. 33.0 days

2. Then the mean tardiness (in days) for all jobs is (assume zero for today's date)

   a. 9.0 days.
   b. 5.4 days.
   c. 3.2 days.
   d. 2.8 days

3. If the following jobs are sequenced according to the DDATE rule then the maximum job tardiness (in days) is (assume zero for today's date)

a. 12 days.
b. 15 days.
c. 16 days.
d. 27 days.

4. Then the total number of jobs that would be late is (assume zero for today's date)

a. 5 jobs.
b. 4 jobs.
c. 3 jobs.
d. 2 jobs.

5. Then job A would be completed on day (assume zero for today's date)

a. 8.
b. 12.
c. 16.
d. 22

Section 6: Process Capability Analysis

Kripa's Salsa company is considering using a new container for its salsa. According to their research, the glass containers for the salsa should have a strength between 185 and 325 psi. Kripa's vendor has provided the following data for evaluation. For sample size 5, $A_2 = 0.577$, $D_4 = 2.115$, $D_3 = 0$ and $d_2 = 2.326$.

Glass Container Strength Data (psi)

Sample	Data				
1	265	205	263	307	220
2	268	260	234	299	215
3	197	286	274	243	231
4	267	281	265	214	318
5	346	317	242	258	276
6	300	208	187	264	271
7	280	242	260	321	228
8	250	299	258	267	293
9	265	254	281	294	223
10	260	308	235	283	277
11	200	235	246	328	296
12	276	264	269	235	290
13	221	176	248	263	231
14	334	280	265	272	283
15	265	262	271	245	301
16	280	274	253	287	258
17	261	248	260	274	337
18	250	278	254	274	275
19	278	250	265	270	298
20	257	210	280	269	251

1. Is there evidence that the process is in control?
a) Yes b) No

2. Is it capable of producing jars with a breaking strength between 185 and 325 psi?
a) Yes b) No

3. Estimate the two sided process capability ratio
a) 0.7 b) 0.79 c) 0.3 d) 0.61

4. Estimate the process capability ratio for upper specification limit
a) 0.7 b) 0.79 c) 0.3 d) 0.61

5. Estimate the process capability ratio for the lower specification limit
a) 0.7 b) 0.79 c) 0.3 d) 0.61

6. Estimate the Process capability index
a) 0.7 b) 0.79 c) 0.3 d) 0.61

7. Give an estimate of non-conformance rate (in ppm).
a) 33,220 ppm b) 11, 669 c) 44,129 d) 44,129

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414