

Time allowed: 2 hr 30 min

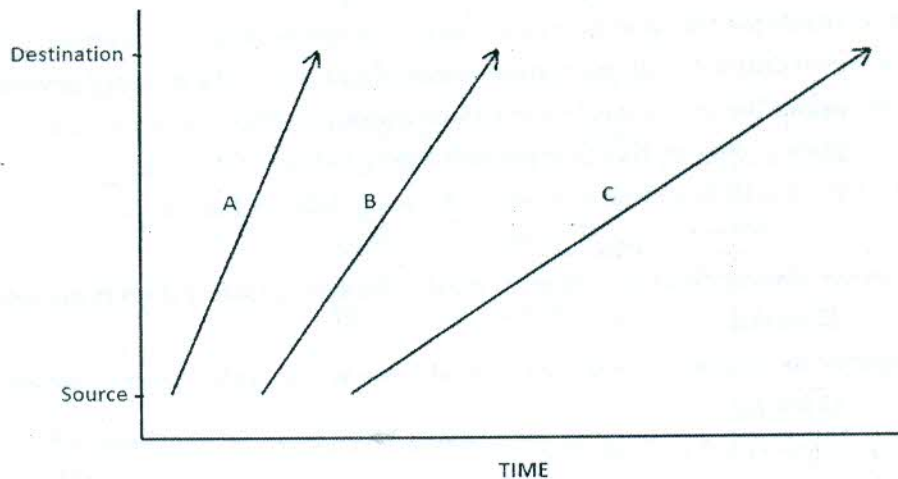
Max Marks: 50

Roll No: \_\_\_\_\_

**Instruction:** Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means**. In case of rough work, please use answer sheet.

**Section A: Short answer questions (Five marks each. Attempt three; total marks 15)**

- A1. The figure below shows the time-space diagram for three different transportation options A, B and C for a certain source to destination. For which option will the safety and pipeline inventory carrying cost be maximum? Why?

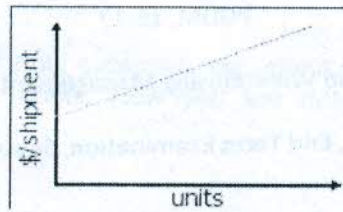


- A2. Given below are some specifications of two different sizes of international containers.

	TEU	FEU
Length	20 ft	40 ft
Volume	33 cu. mt.	67 cu. mt.
Payload	24.8 kkg	28.8 kkg

IKEA sources wooden flat boards and steel panels from Asia to Europe. These items are shipped through the sea route. Which container would you recommend for each of these items and why?

- A3. Consider the transportation cost function shown below. In what way will this impact the total logistics cost which includes purchase, ordering, and inventory carrying costs? Explain very briefly.



- A4. The city of Boston has a population of about 646,000 people and an area of about 90 square miles. Suppose I have 1,000 different locations that I can deliver to within the city and I believe that a good estimate of the travelling salesman factor ( $k_{TSP}$ ) is 1.20. What is the estimated distance for a tour covering 22 of these points?
- A5. What are the three levels of packaging? What purpose does each level serve?

**Section B: 10 marks each. Attempt any 2; total marks 20**

- B1. You have to select a transportation carrier to use for replenishing your inventory. Demand for the item is distributed normally with a mean of 500 units and a standard deviation of 100 units *per week*. The cost of the item to include delivery is \$450. You want a CSL of 95%.
- Option 1: Delivery lead time mean=4 weeks, StdDev = 0.5 week
  - Option 2: Delivery lead time mean=3 weeks, StdDev = 1 week
- a. Suppose you decide to use Option 1. What is the average safety stock in number of units? **(3 marks)**
- b. Suppose you decide to use Option 2. What is the average safety stock in number of units? **(3 marks)**

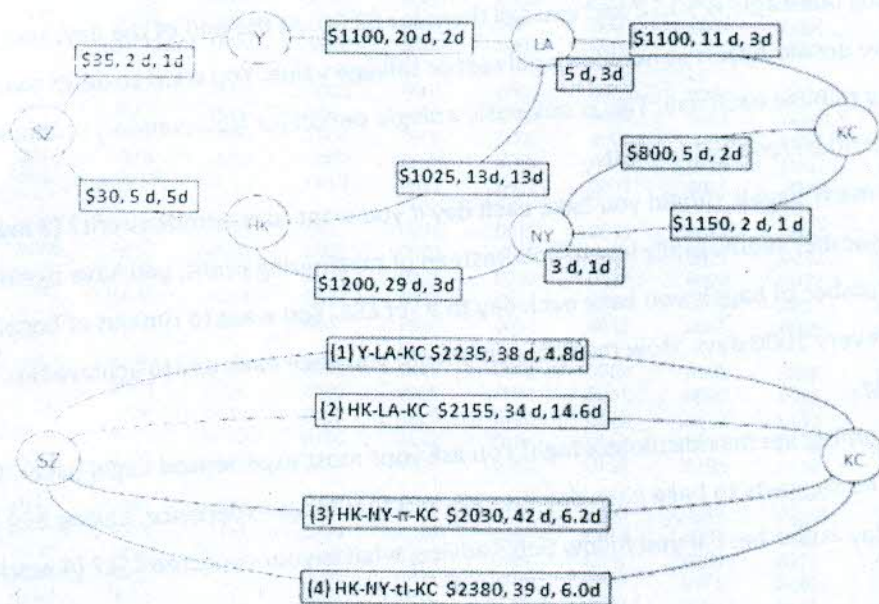
You have noticed how much impact the reliable transportation (lead) time has on your safety stock levels. You want to understand how much more reliable Option 2 (3 weeks average and 1 week standard deviation) would need to be to match the safety stock needed in Option 1.

- c. What would Option 3's new standard deviation of transit time need to be to have the same safety stock level as in Option 2? **(4 marks)**
- B2. You deliver office supplies to firms within an area from your distribution centre located at the southwest corner of the rectangular region which is about 8 miles by 14 miles.
- You expect 100 customer orders per day, about 2 pallets of product each.
  - Local vans carrying the load can handle 5 pallets at most.
  - You estimate it costs about \$10 per stop (to load and unload), \$5 per pallet to deliver to the end customer, and about \$1 a mile for driving.



- Using a circuitry factor of 1.3, what is the total expected line haul distance that a van needs to cover? (2 marks)
- Using a TSP factor of 1.00, what is the total expected local delivery distance? (3 marks)
- What is the expected number of tours that need to be made in a day? (3 marks)
- What is the expected daily delivery cost? (2 marks)

B3. Consider the Shenzhen Shoes problem discussed in class. Suppose the transit time on the APL ocean shipment from Hong Kong to New York changed from a mean of 29 days and a standard deviation of 3 days to a mean of 30 days and a standard deviation of 1 day.



- What would the new expected transit time be for path (4) from Hong Kong to New York to Kansas City via truck in days? (2 marks)
- What would the new standard deviation of transit time be for path (4) from Hong Kong to New York to Kansas City via truck in days? (3 marks)
- By how much will the pipeline inventory cost change (in percent)? (2 marks)
- By how much will safety inventory cost change (in percent)? (3 marks)

### Section C: Case study; 15 marks

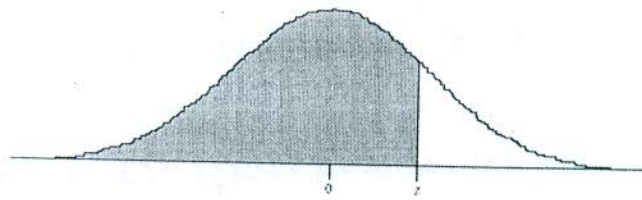
You just took over inventory management for the Bagelicious restaurant. They sell coffee, snacks, and most importantly, bagels. You are trying to determine what demand distribution to use for bagels so that you can estimate how many to bake each day. Of course, no one has any records, but some of the longer tenured employees recall that for a typical day they sell 150 bagels. On the slowest day they recall selling only 75 bagels and the biggest selling day was when they sold 450

bagels. And even then, they recalled selling out - so perhaps there was even more demand for bagels than they captured.

You decide to use a triangle distribution to estimate the distribution of the daily demand.

1. Using the estimates provided by the employees, what is your expected demand for bagels each day? **(1 mark)**
2. Using the estimates provided by the employees, what is the standard deviation of demand for bagels each day? **(2 marks)**
3. Bagelicious prides itself on fresh bagels. So they bake them fresh each day. The cost for baking one bagel is \$0.50 and you sell them for \$2.50. At the end of the day, you will dispose of the unsold bagels at no additional cost or salvage value. You want to determine how many to bake each day. This is obviously a single period (or Newsvendor) problem. What is your critical ratio? **(2 marks)**
4. How many bagels should you bake each day if you want to maximize profit? **(3 marks)**
5. This number seems really low to you. Instead of maximizing profit, you have decided to set the number of bagels you bake each day to a set CSL. You want to run out of bagels only once every 1000 days. How many bagels should you bake each day to achieve this? **(3 marks)**
6. This number seems ridiculously high! You ask your most experienced bagel baker, Bob, how many he suggests to bake each day. He tells you that in his experience, baking 350 bagels each day is the best. If you follow Bob's advice, what is your expected CSL? **(4 marks)**





Normal Deviate										
$z$	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
1.0	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
3.9	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
3.8	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
3.7	.0001	.0001	.0000	.0000	.0000	.0000	.0000	.0000	.0000	.0000
3.6	.0002	.0002	.0001	.0001	.0001	.0001	.0001	.0001	.0001	.0001
3.5	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002	.0002
3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483