Manufacturing Process & Production

Questions

A. Quality Control:

1. A seafood processor uses his facilities to process crab, shrimp, or fish, according to the season of the year. Most operations are manual owing to the nature of the work, need for versatility and lack of investment capital. Complaints from buyers about discrepancies in the quoted weights of packed shrimp have led the processor to initiate a control program. The shrimp are packed in 1-and 5 pound containers. A worker scoops the small shrimp into a container and places it on a balance scale. The final weight adjustment is made by hand adding or removing a few small shrimp from the container. It is necessary to perform the weighting quickly because microbial growth can spoil the shrimp if they are left too long without refrigeration. The results of weighting 10 samples of five 1-pound containers are shown below. Two samples were taken each day by a random selection of containers packed during the day and stored in the cold room. Based on the data provided, develop an x and R control charts.
    a. What are the control limits and centre line for the process average? Construct and discuss the x chart
    b. What are the control limits and centre line for the process variation? Construct and discuss the range chart.

Sample	Weight Measurement (pounds)				
	1	2	3	4	5
1	1.04	1.01	0.98	1.02	1.00
2	1.02	0.97	0.96	1.01	1.02
3	1.01	1.07	0.99	1.03	1.00
4	0.98	0.97	1.02	0.98	0.98
5	0.99	1.03	0.98	1.02	1.02
6	1.02	0.95	1.04	1.02	0.95
7	1.00	0.99	1.01	1.02	1.01
8	0.99	1.02	1.00	1.04	1.09
9	1.03	1.04	0.99	1.02	0.94
10	1.02	0.98	1.00	0.99	1.02

2. The following table contains the measurements of the key length dimensions from a fuel injector. These samples of size five were taken at one hour intervals. Construct a 3-sigma X-bar and R chart for the length of the fuel injector. What can you say about this process?

Sample Number	Observations 1	2	3	4	5
1	.486	.499	.493	.511	.481
2	.499	.506	.516	.494	.529
3	.496	.500	.515	.488	.521
4	.495	.506	.483	.487	.489
5	.472	.502	.526	.469	.481
6	.473	.495	.507	.493	.506
7	.495	.512	.490	.471	.504
8	.525	.501	.498	.474	.485
9	.497	.501	.517	.506	.516
10	.495	.505	.516	.511	.497
11	.495	.482	.468	.492	.492
12	.483	.459	.526	.506	.522
13	.521	.512	.493	.525	.510
14	.487	.521	.507	.501	.500
15	.493	.516	.499	.511	.513
16	.473	.506	.479	.480	.523
17	.477	.485	.513	.484	.496
18	.515	.493	.493	.485	.475
19	.511	.536	.486	.497	.491
20	.509	.490	.470	.504	.512

3. C-spec, Inc. is attempting to determine whether an existing machine is capable of milling an engine parts that has a key specification of 4±0.0003 inches. After a trial run on this machines, C-spec has determined that the machine has a sample mean of 4.001 inches with a standard deviation of 0.002 inches.
    c. Calculate the C_{pk}
    d. Should C-spec use this machine to produce part? Why?

B. Inventory Control:

1. Ray's satellite Emporium wishes to determine the best order size for their best-selling satellite disk (model TS 111). Ray has estimated the annual demand for this model at 1000 units. His cost to carry one unit is $100 per year per unit and he has estimated that each order cost $25 to place. Using the Economic order quantity (EOQ) model, how many should Ray order each time he places an order?
2. Howard Electronics, a small manufacturer of electronic research equipment, has approximately 7000 items in is inventory and has hired Joan Blasco-Paul to manage its inventory. Joan has determined that 10% of the items in inventory are A items, 35% are B items and 55% is C items. She would like to set up a system in which all A items are counted monthly (every 20 working days), all B items are counted quarterly (every 60 working days) and all C items are counted semi-annually (every 120 working days). How many item needs to count each day?
3. A product is made to stock. Annual demand is 86,000 units. Each unit costs $9.50, and the annual holding cost rate 22%. Setup cost to produce this product is $ 800. Determine:
    a. Economic order quantity

b. Total inventory cost for this situation

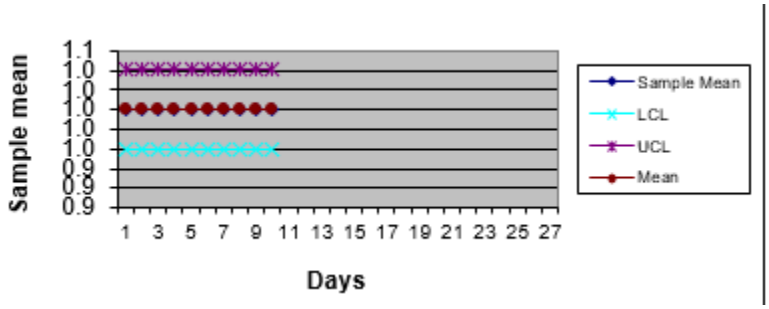
Solution

TaskA:

1.

a.

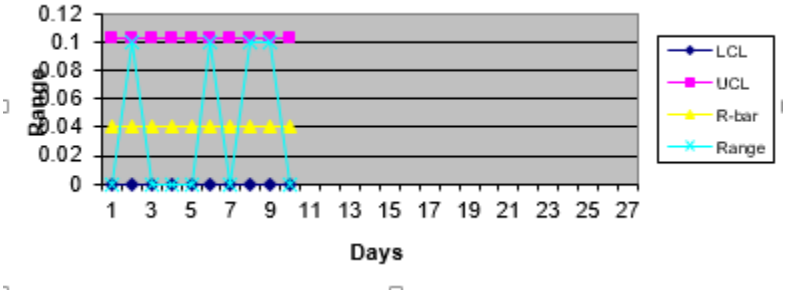
Both control limits are 1. As shown in graph:



Here we can see that X-chart is shown in which mean is at 1 and sample mean is also at 1 but here lower control limit is at 1. All is shown is figure.

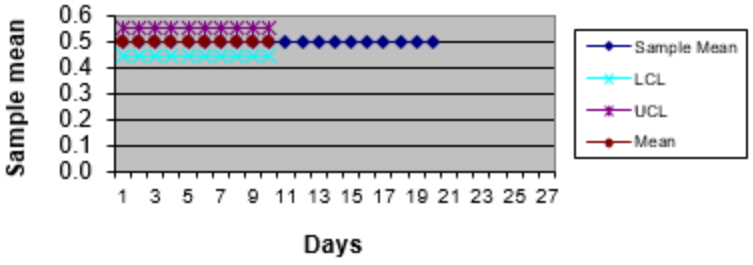
b.

upper control limit is 0.1 and lower is 0. As shown in graph:

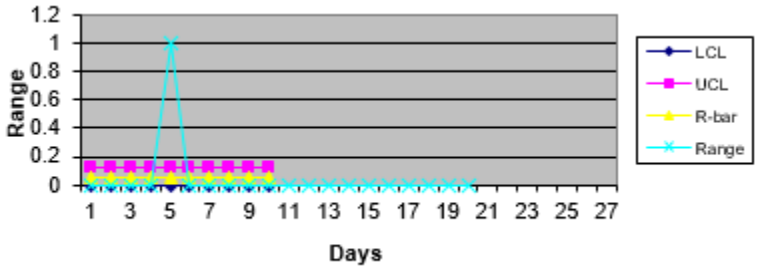


This is range chart in which we can see that range is shown linear between 0 and 1. And here also upper control limit and lower control limit and value is at 0 and 0.1.

2.



Here we can see that sample mean and limits are shown values are 0.5 and 0.55, 0.45 respectively.



Here range is shown between 0 and 1 and also UCL and LCL limits are shown.

3.

Here is formula for calculate (*Cpk*)

$$Cpk = min\left(\frac{USL - \overline{x}}{3 \times \hat{\sigma}} , \frac{\overline{x} - LSL}{3 \times \hat{\sigma}}\right)$$

=Min((4+0.0003-4.001)/(3*0.002),(4.001-(4-0.0003))/(3*0.002))

=min(-0.1167,0.2167)

=-0.1167

No, it should not use this because C_{pk} is in minimum.

TaskB:

1.

$$TC = \frac{D}{Q} * S + \frac{Q}{2} * H$$

$$EOQ = \frac{dTC}{dQ} = sq.root(\frac{2SD}{H})$$

By EOQ model he should order 223.61 each time he places an order.

2.

No. of A items = 700 (10% of 7000)

No. of B items = 2450 (35% of 7000)

No. of C items = 3850 (55% of 7000)

Calculations in working days:

A items counted in 20 days = 700

A items counted in 1 day = 700/20 = 35

B items counted in 60 days = 2450

B items counted in 1 day = 2450/60 = 41

C items counted in 120 days = 3850

C items counted in 1 day = 3850/120 = 32

So total items needed to count each day = 35+41+32

= 108

3.

a.

$$TC = \frac{D}{Q} * S + \frac{Q}{2} * H$$

$$EOQ = \frac{dTC}{dQ} = sq.root(\frac{2SD}{H})$$

EOQ = 7608.57

b.

TC = PD + HQ/2 + SD/Q

Total inventory cost for the product = $877,398.85