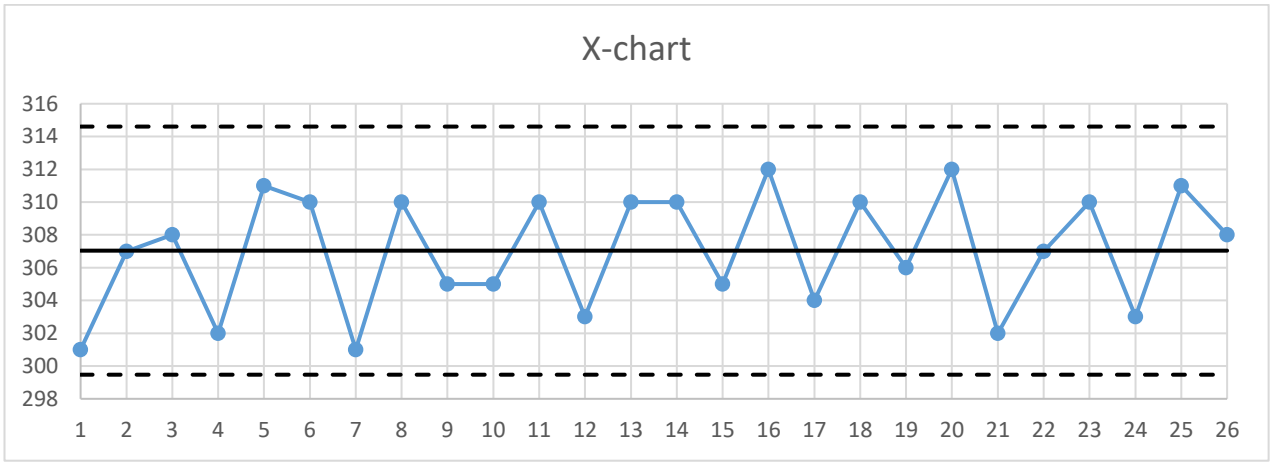
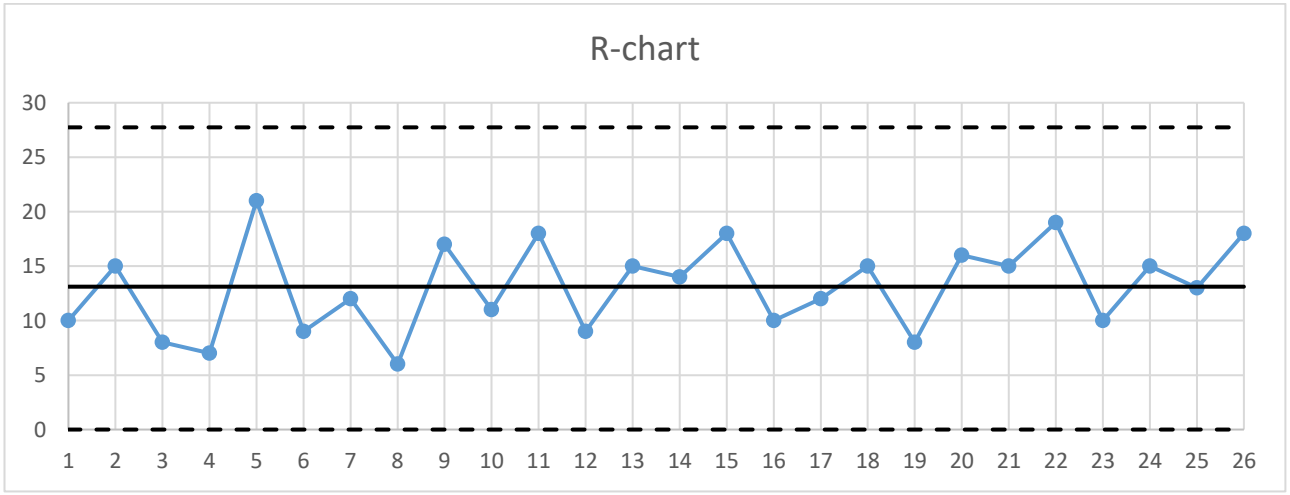
Quality Management Exercises Solutions

QM_1:

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13
Average Weight	301	307	308	302	311	310	301	310	305	305	310	303	310
Range	10	15	8	7	21	9	12	6	17	11	18	9	15
Sample	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
Average Weight	310	305	312	304	310	306	312	302	307	310	303	311	308
Range	14	18	10	12	15	8	16	15	19	10	15	13	18

a)





c)

Assuming that the weight follows a Normal distribution, and the process is in statistical control. The mean and standard deviation of the process estimated from the control chart are (n = 5; d_2 = 2.326):

$$\hat{\mu} = \bar{\bar{X}} = 307.04 \; and \; \hat{\sigma} = \frac{\bar{R}}{d_2} = \frac{13{,}12}{2{,}326} = 5.64 \; grams$$

USL = 315 grams and LSL = 285 grams

To assess the Process Capability, we need to calculate the Cpk:

$$C_{pk} = \min\left(C_{pki}; C_{pks}\right) = (1.3; 0.47) = 0.47,$$

$$C_{pki} = \frac{\hat{\mu} - LSL}{3\hat{\sigma}} = \frac{307.04 - 285}{3 \times 5.64} = 1.3$$

$$C_{pks} = \frac{USL - \hat{\mu}}{3\hat{\sigma}} = \frac{315 - 307.04}{3 \times 5.64} = 0.47$$

As C_{pk} is less than 1, the process is not capable of producing according to specifications. Moreover, we can see that the process is not centered ($Cp_{ki} \neq Cp_{ks}$).

$$C_p = \frac{USL - LSL}{6 \times \sigma} = \frac{315 - 285}{6 \times 5.64} = 0.89$$