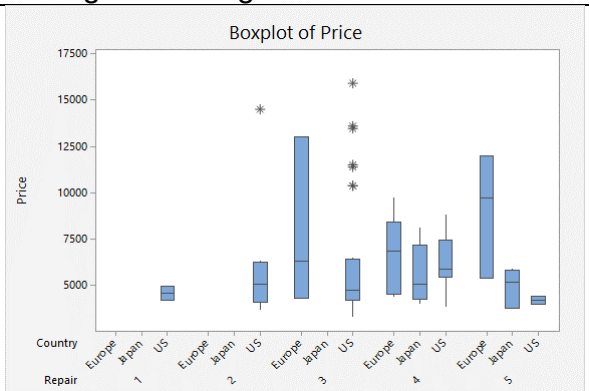
SOLUTIONS

SINGAPORE POLYTECHNIC
2019 / 2020 Semester 1 MST

Module Name: Statistics and Analytics for Engineers **Module Code: MS_SAE**

Course: **Year: 2 FT**

Qn	Solution	Total
1a	Population: All cars models manufactured in the 1970s and 1980s.	
	Sample: The 74 car models manufactured in the 1970s and 1980s used in the study.	
1b	Mileage: Quantitative, continuous	
	Repair: Qualitative, ordinal	
	Country: Qualitative, nominal	
	Weight: Quantitave, continuous	
	Price: Quantitative, continuous	
1c	Mean mileage: 9.05 km / litre	
	Interquartile range for mileage: 3.08 km / litre	
	Shape of distribution of mileage: Positively skewed / Skewed to the right (**Accept**: symmetric if because of mean-median comparison)	
	Percentage of car models with company headquartered in US: 70.3%	
	Japan	
	False	
1d	*r* = -0.823, There is a strong negative linear relationship between mileage and weight.	
1e	 US. There are cars (n=2) with high repair record (5) and low price. (Accept also Japan) similar reason as above.	35
2a	(i)P(produced by Factory Y) $= \frac{1490}{5390} = \frac{149}{539} = 0.276$	6

	(ii)P(a defective transistor produced by Factory Z) = $\frac{300}{5390} = \frac{30}{539} = 0.056$ (iii)P(produced by Factory X or Factory Y) = $\frac{1600+1490}{5390} = \frac{309}{539} = 0.573$	
2b	i. $(0.97)^7 = 0.808$ ii. 1-0.808 = 0.192 iii. No it's not rare. Chances of at least one fault fuse box is pretty high (19%).	9
3(a)	X is discrete	
3(b)	Binomial distribution is appropriate because 1. There is a fixed number of trials in this case, which is the 300 blocks manufactured 2. All the trials are independent. Getting a block that is not strong enough does not affect the probability of the same outcome when another block is examined. 3. Each examination of block ends in either getting a strong block or not a strong block i.e. 2 outcomes only. 4. The probability of getting a block that is not strong enough stays the same i.e. 4%	
3(c)	$P(X=10) = {}^{300}C_{10}(0.04)^{10}(0.96)^{290} = 0.106$ This is not a rare event because the probability exceeds 0.05	
3(d)	$P(X<10) = P(X \le 10) - P(X=10)$ $= 0.343 - 0.106$ $= 0.237$ OR	15

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	Summary Input Distribution: Binomial Number of trials: 300 Event probability: 0.04 Input value: 9 Cumulative Probability x: 9, P(X ≤ x): 0.237043	
3(e)	Expected costs = $300\times0.04\times15=\$180$	
4a i) 4a ii) 4a iii)	Percentile for Adrian = 68/2+50 = 84-th percentile Z- Score for Benedict = $\frac{190-175}{30}=0.5$ Percentile for Benedict = 0.6915 = 69-th percentile Adrian has a higher level of cholesterol compared to Benedict as Adrian's percentile is higher.	6
4bi) 4b ii)	Let *X* be the random variable for the time taken by a customer to wait at the stall. $P(10<X<13)$ $=P(\frac{10-14}{2.1}<Z<\frac{13-14}{2.1})$ $=P(-1.90<Z<-0.48)$ $=0.4713-0.1844$ $=0.2869$ $P(X<x)=0.975$ Z- Score = 1.96	9

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	$\frac{x-\mu}{\sigma} = Z$ $\frac{x-14}{2.1} = 1.96$ x = 18.116 mins "Anyone who waits for more than 18.116 minutes gets free chicken rice" (Accept also if number is rounded **UP**)	
5a	Even though the distribution of life of battery is unknown, by Central Limit Theorem, since n is large (n ≥ 30), then the sampling distribution for sample means is approximately normal. Mean = 11.2 Standard error = $\frac{2.1}{\sqrt{36}}$ = 0.35	4
5b	Let X = life of Aye-fone battery $P(\bar{X} \le 10) = P\left(Z \le \frac{10-11.2}{0.35}\right)$ $= P(Z \le -3.43)$ $= 0.5 - 0.4997 = 0.0003$	6
6	1-Sample t: RON Descriptive Statistics N Mean StDev SE Mean 95% CI for μ 9 97.0222 2.9457 0.9819 (94.7580, 99.2865) *μ: mean of RON* (reference only) a) $\hat{\mu} = 97.0$ b) Margin of error = (99.2865-94.7580)/2=2.26 (c) No. Because we can be at about 95% confident that the actual mean RON of petrol in the tank is between 94.7 to 99.3. As RON = 92 is outside this range, it is unlikely that the tank average RON is 92.	10