#1

1) Mean $= \frac{1+5+10}{3} = 5.33$

2 Standard deviation.

Standard deviation $= \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}}$

x	$x-\bar{x}$	$x-\bar{x}$	$(x-\bar{x})^2$
1	$1-5.33$	-4.33	18.7489
5	$5-5.33$	-0.33	0.1089
10	$10-5.33$	4.67	21.8089
			$\Sigma = 40.6667$

$n=3$

$= \frac{40.6667}{3} = 13.5556$

$= \sqrt{\cancel{8}}$ $= \sqrt{13.5556}$

$= 3.6818$

Standard deviation is 3.6818

3) The two-element samples are

1,1 10,5
5,5 5,1
10,10
1,5
1,10
5,10
10,1

4) Mean of each sample.

1,1	$= \frac{1+1}{2}$	$= 1$
1,5	$= \frac{1+5}{2}$	$= 3$
1,10	$= \frac{1+10}{2}$	$= 5.5$
5,1	$= \frac{5+1}{2}$	$= 3$
5,5	$= \frac{5+5}{2}$	$= 5$
5,10	$= \frac{5+10}{2}$	$= 7.5$
10,1	$= \frac{10+1}{2}$	$= 5.5$
10,5	$= \frac{10+5}{2}$	$= 7.5$
10,10	$= \frac{10+10}{2}$	$= 10$

5) Mean of the sample means

$$\frac{1 + 3 + 5.5 + 3 + 5 + 7.5 + 5.5 + 7.5 + 10}{9}$$

$= 5.33$

6) The sample mean and the population mean are equal thus the population size doesn't affect the sample size. This shows that the sample mean is unbiased estimate of the population mean $E(\bar{x}) = X$

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7) Standard deviation of the sample mean

X	$X - \bar{X}$ ($\bar{X} = 5.33$)	$(X - \bar{X})^2$
1	-4.33	18.7489
3	-2.33	5.4289
5.5	0.17	0.0289
3	-2.33	5.4289
5	-0.33	0.1089
7.5	2.17	4.7089
5.5	0.17	0.0289
7.5	2.17	4.7089
10	4.67	21.8089
		$\Sigma = 61.0001$

Standard deviation of sample mean.

$$\sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$$

$$\sqrt{\frac{61.0001}{9-1}} = 2.7613$$

Standard deviation is 2.7613.

8) The population standard deviation is higher that that of the sample mean, this is due to the elements were picked from a finite population.

2.

$n = 12, 15, 9, 11, 8, 6, 15, 9, 11, 8, 10, 19, 5, 13, 11, 8, 14$
$9, 15, 18, 6, 12, 11, 9, 17, 14, 13, 9, 18, 7$

$n = 30$

$n \geq 30$ - Large sample.

$C.I = 95\%$

$\bar{X} = 11.3667$

$$S^2 = \frac{\Sigma x^2 - n\bar{x}^2}{n-1} = \frac{4293 - 30(11.3667)^2}{30-1} = \frac{416.9667}{29}$$

$S^2 = 14.378$

a) $\bar{X} \pm Z_{\alpha/2} \sqrt{S^2/n}$

$11.3667 \pm Z_{0.975} \sqrt{\frac{14.378}{29}}$

$11.3667 \pm Z_{0.975}\, 0.70413$

$11.3667 \pm 1.96(0.70413)$

11.3667 ± 1.380

$= [9.9866, 12.7468]$

$= [9.9866, 12.7468]$

b) The 95% confidence interval means that in many repetition of the procedure the interval [9.9866, 12.7468] will cover the true mean ie the population sample mean 95% of hours