1) a) $n = 10$, $\bar{y} = 124$, $s = 10$

$H_0: \mu = 110$ vs $H_A: \mu \neq 110$,

$\alpha = 0.01$

$v = n - 1 = 10 - 1 = 9$

$\mu_0 = 110$

Under Ho, the test statistic $T \sim t(9)$.

Observed Test Stat., $T_{obs} = \dfrac{\bar{x} - \mu_0}{s/\sqrt{n}}$

$$T_{obs} = \frac{124 - 110}{10/\sqrt{10}} = \frac{14}{\sqrt{10}} = 4.427$$

Critical Value, $t_{v=9, \frac{\alpha}{2} = 0.005} = 3.250$

$T_{obs} \leq -t_{v, \alpha/2}$ ✗	$T_{obs} \geq t_{v, \alpha/2}$
$4.427 \leq -(3.250)$	$4.427 \geq 3.250$ ✓

So, we reject the Ho and accept th

as $T_{obs} \geq t_{v, \alpha/2}$

b) $n = 8$, $\bar{y} = 0.6$, $s = 0.2$,

$H_0: \mu = 0.5$, vs $H_A: \mu \neq 0.5$

$\alpha = 0.05$

$v = 8 - 1 = 7$, $\mu_0 = 0.5$

Under H_0, Test Statistic $T \sim t(7)$

$$T_{obs} = \frac{\bar{y} - \mu_0}{s/\sqrt{n}} = \frac{0.6 - 0.5}{0.2/\sqrt{8}} = \frac{0.1(2\sqrt{2})}{0.2}$$
$$= \sqrt{2} = 1.414$$

Critical value, $t_{v=7, \frac{\alpha}{2}=0.025} = 2.365$

$-t_{v,\alpha/2} < T_{obs} < t_{v,\alpha/2} \Rightarrow -2.365 < 1.414 < 2.365$

We fail to reject the H_0 ~~when~~ as
$-t_{v,\alpha/2} < T_{obs} < t_{v,\alpha/2}$

c) $n = 25$, $\bar{y} = 33.4$, $s = 6.8$

$H_0 : \mu = 30$ vs $H_A : \mu > 30$

$\alpha = 0.1$, $v = 24$, $\mu_0 = 30$

Under H_0, Test Statistic $T \sim t(24)$

$$T_{obs} = \frac{\bar{y} - \mu_0}{s/\sqrt{n}} = \frac{33.4 - 30}{6.8/\sqrt{25}} = \frac{3.4 \times 5}{6.8_2} = 2.5$$

Critical value, $t_{v=24, \alpha=0.1} = 1.318$

$T_{obs} \geq t_{v,\alpha} \Rightarrow 2.5 \geq 2.318$

We Reject the H_0 & accept H_A, as $T_{obs} \geq t_{v,\alpha}$, upper-tailed test.

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2) a) mean $(\mu) = 55$

sd $(\sigma^2) = 100$

$P(X > 70)$

$$\Rightarrow Z = \cancel{\mu}\ \frac{70-\mu}{\sigma^2} = \frac{70-55}{100}$$

$Z = 0.15$

$$P(X > 70) = P(Z > 0.15)$$
$$= 1 - P(Z < 0.15)$$
$$= 1 - 0.5595$$
$$= 0.4401$$

Probability of any one of these getting a first is 0.4401

2) b) Probability that exactly one of the 10 students will get a first

Given, $n = 10$, Probability that anyone will get a first, $P = 0.4401$

exactly one $\Rightarrow k = 1$

Using Binomial distribution,

$$Pr(k) = \binom{n}{k} P^k (1-P)^{n-k}$$

$$Pr(1) = \binom{10}{1} (0.4401)^1 (1-0.4401)^{10-1}$$

$$= (10)(0.4401)(0.5599)^9$$

$$= (10)(0.4401)(0.00541)$$

$$= 0.02381$$

∴ Probability that exactly one student gets a first is 0.02381

1) c) Probability that the avg mark of class will be above 60.

$$\Rightarrow P(Y > 60) = P\left(\frac{Y - E[Y]}{\sigma(Y)} > \frac{60 - \mu}{\frac{\sigma^2}{\sqrt{n}}}\right)$$

$$= P\left(Z > \frac{60-55}{\frac{100}{\sqrt{10}}}\right)$$

$$= P\left(Z > \frac{5}{10\sqrt{10}}\right) = P\left(Z > \frac{1}{2\sqrt{10}}\right)$$

$$= P(Z > 0.158) = 0.436.$$

∴ Probability that the avg mark of class will be above 60 is 0.436