I AE-I Answer key
Statistics and Numerical Methods.

Part A.

1. Type I Error: Acceptance of H_0 when it is false.
Type II Error: Rejection of H_0 when it is true.

2. It is used to test the significance of the difference between two sample means.
To test the significance of an observed sample correlation coefficient and sample regression co-efficient

3. $$E(a) = \frac{(a+b)(a+c)}{N}$$
$$E(b) = \frac{(a+b)(b+d)}{N}$$
$$E(c) = \frac{(a+c)(c+d)}{N}$$
$$E(d) = \frac{(c+d)(b+d)}{N}$$
$$N = \frac{(a+b+c+d)(ad-bc)^2}{(a+c)(b+d)(a+b)(c+d)}.$$

4. Radomization
Replication
Local Control.

5. Completely Randomized Design
Randomized Block Design
Latin Square Design.

Part B.

6) a) $n_1 = 6 \quad n_2 = 7$

$\bar{x}_1 = 22.3 \quad \bar{x}_2 = 34.42.$

$\Sigma(x_1 - \bar{x}_1)^2 = 81.34.$

$\Sigma(x_2 - \bar{x}_2)^2 = 133.72.$

$$S_1^2 = \frac{\Sigma(x_1-\bar{x}_1)^2}{n_1 - 1} = \frac{81.34}{5} = 16.27$$

$$S_2^2 = \frac{133.72}{6} = 22.29.$$

$H_0: \sigma_1^2 = \sigma_2^2$
$H_1: \sigma_1^2 \neq \sigma_2^2$

LOS: 5%. DOF: $V_1 = 5 \; V_2 = 6$

T.V $(6,5) = 4.95.$

Test Statistics.

$$S_2^2 > S_1^2$$

$$F = \frac{S_2^2}{S_1^2} = \frac{22.29}{16.27} = 1.37$$

C.V < T.V

$1.37 < 4.95$ H_0 accepted

6) b) i) $\bar{x} = 97.2$.

$(x-\bar{x})^2 = 1833.6$.

$S^2 = \frac{\Sigma(x_i-\bar{x})^2}{n_1-1} = 203.78$

$s = \sqrt{203.78} = 14.27$.

$H_0 : \mu = 100$

$H_1 : \mu \neq 100$.

LOS: $\alpha = 5\%$. Dof $= 10-1 = 9$

$T.V = 1.833$.

Test statistics.

$t = \bar{x} - \mu / s/\sqrt{n-1}$

$t = -0.588$

$|t| = 0.588$.

$C.V < t.V$

H_0 accepted.

ii $n = 6$.

H_0: The die is biased

H_1: The die is unbiased

LOS: 5%. dof $= n-1 = 5$.

Test statistics.

$\chi^2 = \Sigma \frac{(O-E)^2}{E}$

$= \frac{258}{20} = 12.9$.

O	E	(O-E)	$(O-E)^2$
30	20	10	100
25	20	5	25
18	20	-2	4
10	20	-10	100
22	20	2	4
15	20	-5	25
120	120		258

C.V T.V

$12.9 > 11.07$

H_0 is rejected.

7) a $n = 900$ $\sigma = 2.61$

$\bar{x} = 3.4$ $\mu = 3.25$.

$H_0 : \mu = 3.25$

$H_1 : \mu \neq 3.25$.

LOS : 5% $T.V = 1.96$.

Test statistics :

$z = \frac{\bar{x} - \mu}{\sigma/\sqrt{n}} = \frac{3.4 - 3.25}{2.61/\sqrt{900}}$

$z = 1.72$.

$|z| = 1.72$.

Conclusion : C.V T.V

$1.72 < 1.96$.

H_0 accepted.

7) a) ii)

H_0: Attributes are independent.

H_0: Attributes are not independent.

LOS $\alpha = 5\%$.

D.of: $(r-1)(s-1) = 1$

$T.V = 3.841$

$E(620) = 585$

$E(380) = 415$.

$E(550) = 585$

$E(450) = 415$.

O	E	(O-E)	$(O-E)^2/E$
620	585	35	2.09
380	415	-35	2.95
550	585	-35	2.09
450	415	35	2.95

$\chi^2 = 1.08$.

C.V > T.V

H_0. Rejected.

Part: B.

8) a) $n_1 = 10$ $n_2 = 8$

$\bar{x}_1 = 6.4$ $\bar{x}_2 = 5$.

$\Sigma(x_1 - \bar{x}_1)^2 = 102.4$

$\Sigma(x_2 - \bar{x}_2)^2 = 82$

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$

LOS: $\alpha = 5\%$

Dof $v_1 = 9$, $v_2 = 7$

$T.V(7,9) = 3.29$

Test statistics.

$$F = \frac{S_2^2}{S_1^2} = \frac{11.71}{11.37} = 1.029.$$

C.V < T.V

H_0 is accepted.

b) H_0: There is no significat difference

H_1: There is significat difference

$N = 10$

$T = 40$

$$\frac{T^2}{N} = 160.$$

$$TSS = \Sigma x_1^2 + \Sigma x_2^2 + \Sigma x_3^2 - \frac{T^2}{N}$$

$= 40$

$$SSC = \frac{(\Sigma x_1)^2}{N_1} + \frac{(\Sigma x_2)^2}{N_1} + \frac{(\Sigma x_3)^2}{N_1} - \frac{T^2}{N}$$

$= 6$.

$SSE = TSS - SSC = 34$

$$MSC = \frac{SSC}{C-1} = 3.$$

$$MSE = \frac{SSE}{N-C} = 4.86.$$

Source of Variation	Sum of squares	dof	MSS	Variane ratio	Table Value
Bt Columns	SSC $= 6$	$C-1$ $= 2$	MST $= 3$	$F_C = \frac{MSE}{MST}$ $= 1.62$	$F_T(7,2)$ $= 19.35$
Error	SSE $= 34$	$N-C$ $= 7$	MSE $= 4.86$		

H_0 accepted $C.V < T.V$.