1.  

(a) \( H_0 : \mu = 3.20, \ H_1 : \mu \neq 3.20 \)  

(b) Test Statistics: \( Z = \frac{\bar{X} - \mu_0}{\sigma/\sqrt{n}} \)  

Observed Test Statistics: \( Z_{obs} = \frac{3.05 - 3.20}{0.34/\sqrt{50}} = -3.12 \)  

(c) Look for -3.12 on the Normal table, and you should count both tail areas, yield P-value to be \( 2 \times 0.0009 = 0.0018 \).  

(d) Since the P-value is very small, we will reject the null hypothesis and conclude that the average thickness is not what we desire.  

2.  

(a) \( \mu_{\bar{X}} = \mu = 1000 \) hours.  

(b) \( \sigma_{\bar{X}} = \sigma/\sqrt{n} = 400/\sqrt{400} = 20 \)  

(c) Approximately normal by C.L.T.  

(d) First, \( Z = \frac{980 - 1000}{20} = -1 \), then find \( P(Z < -1) \) on the normal table to be 0.16.  

3. \( H_0 : \sigma = 0.05, \ H_1 : \sigma < 0.05 \)  

4.  

(a) \( P(X+Y \leq 40) = P(15,15)+P(15,20)+P(20,15)+P(20,20) = 0.05+0.05+0.05+0.10 = 0.25 \)  

(b) \( P(X = 15) = 0.05 + 0.05 + 0.10 = 0.20 \)  

\( P(X = 20) = 0.05 + 0.10 + 0.35 = 0.50 \)  

\( P(X = 30) = 0 + 0.20 + 0.10 = 0.30 \)  

(c) \( P(Y = 15|X = 20) = \frac{P(X=20,Y=15)}{P(X=20)} = 0.05/0.50 = 0.1 \  
\( P(Y = 20|X = 20) = \frac{P(X=20,Y=20)}{P(X=20)} = 0.35/0.50 = 0.7 \)  

5.  

(a) \( E(U) = 2E(X_1) + E(X_2) - E(X_3) = 2 \times 1 + 2 - 3 = 1 \)  

(b) \( Var(U) = 2^2Var(X_1) + Var(X_2) + Var(X_3) = 4 + 1 + 1 = 6 \)