10.2

a) $\beta_1 > 0$

$\beta_2, \beta_3 > 0$

β_4 can be positive or negative

$\beta_5, \beta_6 < 0$

b) Wage can be endogenous since it can be influenced by unobserved factors such as motivation, ability, job experience

e may capture these unobsened factors thus $E(e|wages) = 0$ dose not hold anymore. $\Rightarrow$ the estimators are biased and inconsistent

c) Expert and $Expert^2$ satisfy both requirements of an IV

d) IV: expert and $expert^2$ } The equation is overidentified

Endogenous: Wages } $\Rightarrow$ need the test for IV validity

e) 1st stage $wages = \alpha_1 + \alpha_2 expert + \alpha_3 expert^2 + \alpha_4 educ + \alpha_5 age + \alpha_6 kids + ..$

2nd stage $Hours = \beta_1 + \beta_2 \widehat{wages} + \beta_3 educ + \beta_4 kids + \beta_5 Nwifeinc + \varepsilon$

Compare to OLS results

10.3.

a) $x = Y_1 + \theta_1 z + v$ $\qquad \theta_1 = \frac{cov(z,x)}{var(z)} - \frac{cov(z,v)}{var(z)}$

Since $cov(v,z) = 0$ so

$$\theta_1 = \frac{cov(z,x)}{var(z)}$$

b) $y = \beta_1 + \beta_2 x + e = \beta_1 + \beta_2 (Y_1 + \theta_1 z + v) + \varepsilon$

$= (\beta_1 + \beta_2 Y_1) + \beta_2 \theta_1 z + (\beta_2 v + \varepsilon)$

$= \pi_0 + \pi_1 + u$

d) $\pi_1 = \beta_2 \theta_1 \Rightarrow \beta_2 = \pi_1 / \theta_1$

e) $\theta_1 = \frac{\Sigma (x_i - \bar{x})(z_i - \bar{z})}{\Sigma (z_i - \bar{z})^2} \Rightarrow \frac{cov(z,x)}{var(z)} = \phi_1$

$\pi_1 = \frac{\Sigma (y_i - \bar{y})(z_i - \bar{z})}{\Sigma (z_i - \bar{z})^2} \Rightarrow \frac{cov(y,z)}{var(z)} = \pi_1$

$\hat{\beta}_2 = \frac{\hat{\alpha}_1}{\hat{\pi}_1} \Rightarrow \beta_2 = \frac{\alpha_1}{\pi_1}$