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EE320 HW5 Suggested answers

1. $(Q_1^*, Q_2^*, Q_3^*) = \left(\frac{16}{9}, \frac{62}{9}, \frac{10}{3}\right)$

$\pi^*(Q_1^*, Q_2^*, Q_3^*) = 189.33$

SOC: $|\bar{H}| = \begin{vmatrix} 0 & 1 & 1 & 1 \\ 1 & -3 & 0 & 0 \\ 1 & 0 & -6 & 0 \\ 1 & 0 & 0 & -4 \end{vmatrix}$; $|\bar{H}_2| > 0$, $|\bar{H}_3| < 0$

2. $C_1^* = \frac{M}{1+\beta}$, $C_2^* = \frac{M\beta(1+r)}{1+\beta}$

$U^*(C_1^*, C_2^*) = \ln\left(\frac{M}{1+\beta}\right) + \beta \ln\left(\frac{M\beta(1+r)}{1+\beta}\right)$

$\frac{\partial C_1^*}{\partial r} = 0$ $\frac{\partial C_1^*}{\partial \beta} = -\frac{M}{(1+\beta)^2} < 0$

$\frac{\partial C_2^*}{\partial r} = \frac{M\beta}{1+\beta} > 0$ $\frac{\partial C_2^*}{\partial \beta} = \frac{M(1+r)(1+\beta) - M\beta(1+r)}{(1+\beta)^2} > 0$

3. $x^* = 50$, $y^* = 200$, $U^* = 26.9$

b). Shadow price : $\lambda^* = 0.00434$

new $U^* = 26.9 + (1650 - 1300)\lambda^* \approx 28.2$

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4. a). $(x^*, y^*) = (42, 30)$

b). $(x^*, y^*) = \left(\frac{92}{3}, \frac{124}{3}\right)$

5. $L^* = \dfrac{\beta C_0}{w(\alpha+\beta)}$

$K^* = \dfrac{\alpha C_0}{r(\alpha+\beta)}$

$$|\bar{H}| = \begin{vmatrix} 0 & r & w \\ r & \alpha(\alpha-1)AK^{\alpha-2}L^{\beta} & \alpha\beta K^{\alpha-1}L^{\beta-1} \\ w & \alpha\beta K^{\alpha-1}L^{\beta-1} & \beta(\beta-1)AK^{\alpha}L^{\beta-2} \end{vmatrix} > 0$$