Solution Keys:

1 $x_{ij} = 1$ if path $i - j$ taken, 0 otherwise. Min. $z = 3x_{OA} + 6x_{OB} + 6x_{AC} + 5x_{AD} + 4x_{BC} + 5x_{BD} + 3x_{CT} + 2x_{DT}$ subject to: (exclusionary constraints) $x_{OA} + x_{OB} = 1, x_{AC} + x_{AD} + x_{BC} + x_{BD} = 1, x_{CT} + x_{DT} =$, (contingent constraints) $x_{AC} + x_{AD} \leq x_{OA}, x_{BC} + x_{BD} \leq x_{OB}, x_{CT} \leq x_{AC} + x_{BC}, x_{DT} \leq x_{AD} + x_{BD}$.

2 (a) $P = \begin{bmatrix} .264 & .368 & .368 \\ .264 & .368 & .368 \\ .264 & .368 & .368 \end{bmatrix}$ (b) $P^2 = P$, so $P\{X_{t+2} = 2|X_t = 1\} = p_{12} = .368$. (c) $P\{T_{02} = 2\} = p_{00}P\{T_{02} = 1\} + p_{01}P\{T_{12} = 1\} = p_{00}p_{02} + p_{01}p_{12} = 0.233$. (d) $\mu_{02} = \mu_{12} = 2.7$ weeks. (e) $E(S_t) = 0.896$ cameras per week.

3 (a) $P = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0.01 & 0 & 0.99 & 0 \\ 0.05 & 0 & 0 & 0.95 \\ 0 & 0 & 0 & 1 \end{bmatrix}$. (b) State (3). (c) $0.01 + 0.99(0.05) = 0.0545$. Or consider only the original warranty not any replacement warranty, (a) $P = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0.01 & 0 & 0.99 & 0 \\ 0.05 & 0 & 0 & 0.95 \\ 0 & 0 & 0 & 1 \end{bmatrix}$. (b) State (0) and (3). (c) Solve $Pf = f$ with $f_{00} = 1, f_{30} = 0$ to have $f_{10} = 0.0545$ for any new sales to claim the warranty.

4 (a) $W_q = 1$ min.; (b) $W_q = 40$ sec.; (c) $W_q(s = 2) - W_q(s = 3) = 35$ sec. (Common syntax error: $\sum_n a_n + b = (\sum_n a_n) + b \neq \sum_n (a_n + b)$)

5 Optimal path $A - B - E - G$ with $z^* = 27$.

6 Final tabuleau after only one iteration:

		z	x_1	x_2	x_3	x_4	x_5	rhs
	z	1	0	0	1	0	2	24
basic variable	x_1	0	1	0	1	0	0	4
	x_4	0	0	0	5	1	-3	5
	x_2	0	0	1	-2	0	1	2

for solution $z^* = 24$, $(x_1^*, x_2^*) = (4, 2)$. (b) $w^* = z^* = 24$, $(y_1^*, y_2^*, y_3^*) = (1, 0, 2)$, coefficients of the (x_3, x_4, x_5) for the final tabuleau of (a). (c) Making the coefficient of x_3 a leading 1 by row operation to recover the initial tabuleau:

		z	x_1	x_2	x_3	x_4	x_5	rhs
	z	1	-5	-2	0	0	0	0
basic variable	x_3	0	1	0	1	0	0	4
	x_4	0	1	3	0	1	0	15
	x_5	0	2	1	0	0	1	10

which gives $A = \begin{bmatrix} 1 & 0 \\ 1 & 3 \\ 2 & 1 \end{bmatrix}$ as well as c and b.

End