1. First of all, note that \( \mathbb{E}[L] = \mathbb{E}[M] = 300 \).

(a) All we can say for sure is that Jeb is not risk neutral, because a risk-neutral person would be indifferent between \( L \) and \( M \).

(b) Ann prefers \( M \) to $312 for sure and she prefers $312 to $300. Thus, by transitivity, she must prefer $300 to \( L \), that is, \( L \) to $300 for sure. Hence she is risk loving.

(c) Bruno prefers $295 for sure to \( L \) and prefers $300 to $295. Thus, by transitivity, he must prefer $300 to \( L \), that is, \( L \) to $300 for sure to \( L \). Hence he is risk averse.

2. (a) \( W_0 = 7,800, \quad \ell = 7,800 - 3,000 = 4,800 \). Since the slope of an isoprofit line is \( -\frac{p}{1-p} \) we must solve \( -\frac{p}{1-p} = -\frac{1}{5} \), that is, \( 5p = 1 - p \), which gives \( p = \frac{1}{6} = 0.1667 \).

(b) \( NI = \left( \frac{7,800}{5}, \frac{3,000}{5} \right) \) so that \( \mathbb{E}[NI] = \frac{1}{5} 7,800 + \frac{1}{5} 3,000 = 7,000 \).

(c) Since the isoprofit line that goes through \( M \) is the zero-profit line, \( \pi(C) = 0 \).

(d) Starting from \( NI \), if you reduce the horizontal coordinate to 0 (that is, by 3,000) then the vertical coordinate must be increased by \( \frac{1}{5} 3,000 = 600 \) and thus to \( 7,800 + 600 = 8,400 \) (giving the vertical intercept). Thus the equation of the line is \( W_2 = 8,400 - \frac{1}{5} W_1 \).

(e) Since point \( C \) is on the 45\(^0\) line, its coordinates must be equal: \( W^C_1 = W^C_2 \). Using this fact in the equation we write \( W^C_1 = 8,400 - \frac{1}{5} W^C_1 \) and solve for \( W^C_1 \) to get \( W^C_1 = 7,000 \). Hence \( C = (7000, 7000) \). The premium of contract \( C \) is 7,800 - 7,000 = 800 and the deductible is 0 (it is a full-insurance contract). Alternatively, since \( \pi(C) = 0 \) and \( C \) is a full-insurance contract, then the premium must be equal to the expected loss \( p \ell = \frac{1}{6} 4,800 = 800 \).

(f) \( h_A = 7,800 - 7,000 = 800, \quad D_A = 7,000 - 6,000 = 1,000 \).

(g) Since \( B \) is on the isoprofit line that goes through \( A \), \( \pi(B) = \pi(A) \). Now, using (f), \( \pi(A) = h_A - p(x - D_A) = 800 - \frac{1}{6} (4,800 - 1,000) = 166.667 \).

(h) Starting from \( A \) if the horizontal co-ordinate is reduced to 0 (thus by 6,000) then the vertical coordinate must be increased by \( \frac{1}{5} 6,000 = 1,200 \) to 7,000 + 1,200 = 8,200 (this is the vertical intercept). Thus the equation is \( W_2 = 8,200 - \frac{1}{5} W_1 \).

(i) Since point \( B \) is on the 45\(^0\) line, its coordinates must be equal: \( W^B_1 = W^B_2 \); thus from \( W^B_1 = 8,200 - \frac{1}{5} W^B_1 \) solve for \( W^B_1 \) to get \( W^B_1 = 6,833.333 \). Hence \( B = (6833.333, 6833.333) \). Thus the premium of contract \( B \) is 7,800 - 6,833.333 = 966.667 and the deductible is 0.
Alternatively, since $B$ is a full-insurance contract, the profit from contract $B$ is $h_B - p^\ell$ and by (g) this is equal to $166.667$; thus solving $h_B - \frac{1}{6}4,800 = 166.667$ we get $h_B = 966.667$.

(j) $A = \begin{pmatrix} 6,000 & 7,000 \\ \frac{1}{6} & \frac{5}{6} \end{pmatrix}$, $B = \begin{pmatrix} 6,833.333 \\ 1 \end{pmatrix}$. $\mathbb{E}[A] = 6,000 \frac{1}{6} + 7,000 \frac{5}{6} = 6,833.333 = \mathbb{E}[B]$.

(k) No Insurance and contract $C$ have the same expected value, namely $7,000$.

(l) $B$ gives the expected value of $A$ for sure.

(m) She prefers $6,833.333$ for sure to NI, whose expected value is $7,000$. Since more money is better than less, $7,000$ is better than $6,833.333$. Thus she must prefer $7,000$ to NI and thus is risk averse.

3. (a) Her normalized utility function is $u_z = \frac{z_1}{a} z_2 \frac{z_3}{a} 0$ with $0 < a < 1$. The expected utility of lottery $O$ is $\frac{98}{100}$ while the expected utility of $N$ is $a$. Hence, if she decides to have the operation, it must be that $a < \frac{98}{100}$.

(b) This is a meaningless question, since the notion of risk aversion applies only to money lotteries and the two lotteries $O$ and $N$ are not money lotteries. Thus the answer is “we cannot tell”.

(c) $z_2$: No insurance, operation, success $(12,000, H)$

(d) $z_3$: No insurance, no operation $(12,000, P)$

(e) $z_3$: No insurance, operation, failure $(12,000, D)$

(f) $z_4$: Insurance, operation, success $(4,000, H)$

(g) $z_5$: Insurance, operation, failure $(29,000, D)$

(h) We don’t know how she ranks $O$ versus $N$ (because we don’t know whether $U(z_2)$ is greater than, less than, or equal to, $\frac{98}{100}$). However, from her ranking we know that $U(z_4) > U(z_3) > U(z_2)$ and thus the expected utility of $I$ is certainly higher than the expected utility of $N$. Hence she will have the operation; what we don’t know is whether she will also buy insurance, because we don’t know how she ranks $I$ versus $O$.

(i) Her answer means that she prefers $I$ to $O$. As in part (a), $U(z_1) = 1$ and $U(z_2) = 0$ so that $\mathbb{E}[U(O)] = \frac{98}{100}$. On the other hand, $\mathbb{E}[U(I)] = \frac{98}{100} U(z_4) + \frac{2}{100} U(z_5)$. Thus it must be that $\frac{98}{100} U(z_4) + \frac{2}{100} U(z_5) > \frac{98}{100}$, that is, $49U(z_4) + U(z_5) > 49$.

(j) From $\begin{pmatrix} z_3 \\ 0.6 \end{pmatrix} \sim z_5$ we get $U(z_5) = 0.94$ and from $\begin{pmatrix} z_4 \\ 0.6 \end{pmatrix} \sim z_4$ we get $U(z_4) = \frac{98}{100} 0.94 + \frac{2}{100} 0.94 = 0.989 > 0.98 = \mathbb{E}[U(O)]$. Hence her answer is indeed consistent.

(k) It follows from the above that Amy will buy insurance and have the operation (since $I \succ O$ and $I \succ N$).