44. (a) For a given value of l, m_l varies from $-l$ to $+l$. Thus, in our case $l = 3$, and the number of different m_l's is $2l + 1 = 2(3) + 1 = 7$. Thus, since $L_{\text{orb},z} \propto m_l$, there are a total of seven different values of $L_{\text{orb},z}$.

(b) Similarly, since $\mu_{\text{orb},z} \propto m_l$, there are also a total of seven different values of $\mu_{\text{orb},z}$.

(c) Since $L_{\text{orb},z} = m_l h/2\pi$, the greatest allowed value of $L_{\text{orb},z}$ is given by $|m_l|_{\max} h/2\pi = 3h/2\pi$; while the least allowed value is given by $|m_l|_{\min} h/2\pi = 0$.

(d) Similar to part (c), since $\mu_{\text{orb},z} = -m_l \mu_B$, the greatest allowed value of $\mu_{\text{orb},z}$ is given by $|m_l|_{\max}\mu_B = 3eh/4\pi m_e$; while the least allowed value is given by $|m_l|_{\min}\mu_B = 0$.

(e) From Eqs. 32-3 and 32-9 the z component of the net angular momentum of the electron is given by

$$L_{\text{net},z} = L_{\text{orb},z} + L_{s,z} = \frac{m_l h}{2\pi} + \frac{m_s h}{2\pi} \ .$$

For the maximum value of $L_{\text{net},z}$ let $m_l = [m_l]_{\max} = 3$ and $m_s = \frac{1}{2}$. Thus

$$[L_{\text{net},z}]_{\max} = \left(3 + \frac{1}{2}\right)\frac{h}{2\pi} = \frac{3.5h}{2\pi} \ .$$

(f) Since the maximum value of $L_{\text{net},z}$ is given by $[m_J]_{\max} h/2\pi$ with $[m_J]_{\max} = 3.5$ (see the last part above), the number of allowed values for the z component of $L_{\text{net},z}$ is given by $2[m_J]_{\max} + 1 = 2(3.5) + 1 = 8$.