7A.

Entropy(S) = $-P_{\oplus}\log_2 P_{\oplus} - P_{\ominus}\log_2 P_{\ominus}$

Entropy(S) = $-\left(\frac{4}{10}\log_2\frac{4}{10} + \frac{6}{10}\log_2\frac{6}{10}\right) = 0.9709$ Total Entropy

Age:

	Yes	NO	Total
Young	2	2	4
Presbyopic	1	2	3
Prepresbyopic	1	2	3

Young Calculation: $2/4 = 0.5$ $2/4 = 0.5$

$-(0.5\cdot\log_2(0.5) + 0.5\log_2(0.5) = 1.0$

Presbyopic: $P_{yes} = 1/3 = 0.333$, $P_{NO} = 2/3 = 0.667$

$-(0.333\cdot\log_2(0.333) + 0.667\cdot\log_2(0.667) = 0.9183$

Prepresbyopic: $-(0.333\cdot\log_2(0.333) + 0.667\cdot\log_2(0.667) = 0.9183$

Weighted Average Entropy Age: $\left(\frac{4}{10}\right)\cdot 1 + \left(\frac{3}{10}\right)\cdot 0.9183 + \left(\frac{3}{10}\right)\cdot 0.9183$
$= 0.951$

Information Gain:

$H(S) - H(age) = 0.9709 - 0.951 = 0.02$

Spectacle Prescription

$$H(\text{Myope}) = -\left(\frac{4}{8}\right)\log_2\left(\frac{4}{8}\right) - \left(\frac{4}{8}\right)\log_2\left(\frac{4}{8}\right) = 1.0$$

$$H(\text{Hypermetrope}) = -\left(\frac{0}{2}\right)\log_2\left(\frac{0}{2}\right) - \left(\frac{2}{2}\right)\log_2\left(\frac{2}{2}\right) = 0$$

$$H(\text{spectacle prescription}) = \frac{8}{10}\cdot 1.0 + \frac{2}{10}\cdot 0 = 0.8$$

Information Gain = $0.9709 - 0.8 = \boxed{0.1709}$

Astigmatism

Yes: 2 Yes, 2 NO

NO: 2 Yes, 4 NO

$$H(\text{Yes}) = -\left(\frac{2}{4}\log_2\frac{2}{4} + \frac{2}{4}\log_2\frac{2}{4}\right) = 1.0$$

$$H(\text{NO}) = -\left(\frac{2}{6}\log_2\frac{2}{6} + \frac{4}{6}\log_2\frac{4}{6}\right) = 0.918$$

Weighted Entropy = $H(\text{Astigmatism}) = \left(\frac{4}{10}\cdot 1.0\right) + \left(\frac{6}{10}\cdot 0.918\right) = 0.951$

Information Gain = $0.9709 - 0.951 = \boxed{0.0199}$

Tear Production Rate

	Yes	NO	Total
Reduced	1	5	6
Normal	3	1	4

$$H(\text{reduced}) = -\left(\frac{1}{6}\log_2\frac{1}{6} + \frac{5}{6}\log_2\frac{5}{6}\right) = 0.651$$

$$H(\text{normal}) = -\left(\frac{3}{4}\log_2\frac{3}{4} + \frac{1}{4}\log_2\frac{1}{4}\right) = 0.811$$

$$H(\text{tear production rate}) = \left(\frac{4}{10}\cdot 0.811\right) + \left(\frac{6}{10}\cdot 0.651\right) = 0.714$$

Information Gain = $0.9709 - 0.714 = \boxed{0.257}$

Decision Tree