3문제에 300점, 문제당 100점

I. 처녀자리 은하단

1. 위의 표로부터 $\sum_i \frac{d_i}{s_i^2} = 56.1082$ and $\sum_i \frac{1}{s_i^2} = 3.5485$, so:

$$d_{avg} = \frac{56.1082}{3.5485}\ \text{Mpc} = 15.81\ \text{Mpc} \qquad \textbf{(30\%)}$$

2. 불확도(rms):

$$s_d = \sqrt{\frac{1}{\sum_i \frac{1}{s_i^2}}} = \sqrt{\frac{1}{3.5485}}\ \text{Mpc} = 0.53\ \text{Mpc}$$

$$d_{Virgo} = 15.81 \pm 0.53\ \text{Mpc} \qquad \textbf{(10\%)}$$

3. 허블 상수

$$H_0 = \frac{v}{d_{avg}} = \frac{1136\ \text{km/s}}{15.81\ \text{Mpc}} = 71.9\ \text{km/sec/Mpc} \qquad \textbf{(15\%)}$$

불확도:

$$s_{H_0} = \frac{s_d}{d_{avg}} H_0 = \frac{0.53}{15.81} \times 71.85 = 0.0335 \times 71.85 = 2.4\ \text{km/sec/Mpc} \qquad \textbf{(15\%)}$$

허블 상수: $H_0 = 72 \pm 2\ km/\text{sec}/Mpc$ **(5%)**

4. 허블 시간:

$$H_0^{-1} = \frac{1}{H_0} = \frac{1}{71.85\ \text{km/sec/Mpc}} \times 3.086 \times 10^{10}\ \text{km/Mpc} = 4.29 \times 10^{17}\ \text{sec} = 13.6\ \text{Gyr} \qquad \textbf{(20\%)}$$

불확도는 3.35%이며 이는 0.45 Gyr이다. (5%)