1. Exam Information

2. Number 2

2.1 $\frac{2}{8} = \boxed{\dfrac{1}{4}}$

2.2 $P(H) = P(H|F) \cdot P(F) + P(H|BH) \cdot P(BH) + P(H|BT) \cdot P(BT)$

$P(H) = \frac{1}{2} \cdot \frac{2}{8} + \frac{3}{4} \cdot \frac{3}{8} + \frac{1}{4} \cdot \frac{3}{8}$

$P(H) = \frac{1}{8} + \frac{9}{32} + \frac{3}{32} = \frac{16}{32} = \boxed{\dfrac{1}{2}}$

2.3 $P(F|TTH) = \frac{P(TTH|F) \cdot P(F)}{P(TTH|F) \cdot P(F) + P(TTH|BH) \cdot P(BH) + P(TTH|BT) \cdot P(BT)}$

$P(F|TTH) = \frac{\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{2}{8}}{\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{2}{8} + \frac{1}{4}\frac{1}{4}\frac{3}{4}\frac{3}{8} + \frac{3}{4}\frac{3}{4}\frac{1}{4}\frac{3}{8}} = \boxed{\dfrac{4}{13}}$

2.4 $P(H) = P(H|F) \implies \frac{1}{2} = \frac{1}{2}$, Therefore, they are $\boxed{\text{independent}}$.

3. Varied questions

3.1 $P(A_2|A_1) = \boxed{\dfrac{3}{51}}$

3.2 These events are independent, therefore $\boxed{\dfrac{4}{52}}$

3.3 Let D: "Person has Disease", T: "Person tested positive", d: "Person does NOT have disease.

The probability that a person with the disease will test positive is 0.99
The probability that a person with the disease will test negative is 0.01

The probability that a person without the disease will test positive is 0.02
The probability that a person without the disease will test negative is 0.98

$P(D|T) = \frac{P(T|D) \cdot P(D)}{P(T|D) \cdot P(D) + P(T|d) \cdot P(d)}$

$P(D|T) = \frac{(0.99) \cdot (\frac{1}{10{,}000})}{(0.99) \cdot (\frac{1}{10{,}000}) + (0.02) \cdot (1 - \frac{1}{10{,}000})} \approx \boxed{0.0049261084}$

3.4 Sample Variance: $\frac{\sum(x-\bar{x})^2}{n-1} = \boxed{2.2}$