1) A) The probability of success should be close to 1 for large $n$ since the conditions for not succeeding require that the first 2 flips not succeed and the second and third flips don’t succeed and… The product of these probabilities goes to 0 for large $n$.

B) An automaton showing all paths to success is

![Automaton Diagram]

Letting $L_k$ denote the language for success starting in state $k$,

$L_0 = hL_1 + tL_0$
$L_1 = hL_2 + tL_0$
$L_2 = hL_2 + tL_2 + \epsilon$ (empty string)

and these languages have generating functions

$L_0 = zL_1 + zL_0$
$L_1 = zL_2 + zL_0$
$L_2 = zL_2 + zL_2 + 1$

The GF we seek is $L_0(z) = \frac{z^2}{(1-2z)(1-z-z^2)}$.

C) $\frac{z^2}{(1-2z)(1-z-z^2)} = \frac{\alpha}{(1-2z)} + \frac{\beta z + \gamma}{(1-z-z^2)}$. Solving this equation, $\alpha = 1$ (as suggested by part A), $\beta = \gamma = -1$, yielding $[z^n]L(z) = 2^n - F_{n+1} - F_n$.

2. The probability that a designated person gets heads and everyone else gets tails is $2 - \frac{1}{n}$. The probability that the designated person is odd-person-out is $2 - \frac{1}{n}$. The probability that on any flip there is an odd-person-out is $n2^{1-n}$. Since each pass is independent of the other passes and the probability of success (identifying an odd-person-out) is constant, the waiting time is geometrically distributed. The expected waiting time is the reciprocal of the probability of success, or $\frac{2^{n-1}}{n}$. 