Calculation of probabilities in a contact-network

Consider the contact network depicted in Figure 21.8(a) as in the text and also on slide 9 of Lecture 43. Lets compute the probability that nodes v, w will contract the disease on the days that they can contract the disease.
Let p be the probabilty of the disease spreading from some node a to node b on any day that a and b are in contact. We assume that u became infected on day 1.
Let $P(a, t)$ be the probablility that node a first becomes infected on day t and hence is contagious for days $t, t+1, t+2, t+3, t+4$.
For node v, we have the consider $t = 1, 2, 3, 4, 5$. It should be easy to see that $P(v, t) = (1-p)^{t-1} * p$ for $1 \leq t \leq 5$ and $P(v, t) = 0$ for $t > 5$.

Continuation of calculation

Let $P(w,t)$ similarly denote the probability that w first becomes infected at time t This will be non-zero precisely for those days t such that v can still be contagious at time t and v and w are in contact at time t. That is, $t = 7, 8, 9$ since v is no longer contagious at time t = 10. So
$P(w,7) = [P(v,3) + P(v,4) + P(v,5)] * p$
$P(w,8) = [P(v,4) + P(v,5)] * (1-p) * p$ and
$P(w,9) = [P(v,5)] * (1-p)^2 * p$

For definiteness and simplicity , let $p = 1/2$.
Then $P(v,1) = 1/2, P(v,2) = 1/4, P(v,3) = 1/8, P(v,4) = 1/16$ and $P(v,5) = 1/32$ and the probability that v will ever be infected is $\sum_{1 \leq t \leq 5} P(v,t)$ which is also equal to $1 - (1-p)^5 = 31/32$.
$P(w,7) = 7/32 * 1/2 = 7/64, P(w,8) = 3/32 * 1/2 = 3/64$ and $P(w,9) = 1/32 * 1/2 = 1/64$ and the probability that w will ever be infected is $11/64$.