THE PROBLEM HERE IS THAT WHETHER A SIGNAL WILL FAIL OR NOT IS NOT KNOWN. ALL THAT IS KNOWN IS THAT:

PROB. (A SIGNAL FAILS AT TIME PERIOD, t) $= p_t$.

HENCE THE NUMBER OF SIGNALS THAT WILL FAIL IN TIME PERIOD, t (given as n_t) IS ALSO A RANDOM VARIABLE.

PROB. (n_t FAILS IN TIME PERIOD, t) $= \binom{n}{n_t} p_t^{n_t} \cdot (1-p_t)^{n-n_t}$

i.e. n_t IS A BINOMIAL RANDOM VARIABLE WITH PARAMETERS (n, p_t).

THE COST PER TIME PERIOD WILL DEPEND ON n_t WHICH IS A RANDOM VARIABLE. IT IS PROPOSED THEREFORE THAT EXPECTED COST PER TIME PERIOD BE USED. EXPECTED COST IS A REASONABLE CRITERION HERE SINCE SIGNALS ARE EXPECTED TO OPERATE FOR A LONG TIME.

$E(n_t)$: Expected number of failed signals at time period t.

c_1 : Cost of servicing a failed signal (this may include the delay cost to travellers)

c_2 : cost of preventive maintenance on a signal.

T : The number of time periods at the end of which preventive maintenance will be done.

$EC(T)$: Expected cost

T^*: optimal value of T.