HW Problem 8:   **SOLUTIONS**   **2005**
Design a system for the collection of residential yard waste (Scenario B or C),   1   time per week

a. Determine the amount of yard waste generated and collected per capita in the residential area of
Dusseau's Folly, if   87   % of the yard waste in Dusseau's Folly is generated by the residential area.
Non-residential delivers   5   % of the yard waste received by the composting facility.

        Out of every 100 lbs of MSW generated,   18.1   pounds of yard waste is generated.
        Of that,   87   % is residential. From an earlier problem, per capita MSW gen (lbs   5.8

        Per capita res. yw gen. = per cap. MSW gen. x frac. yw is of gen. MSW x frac. yw gen. by res.
                5.8   x   0.181   x   0.87
            =   0.91   lb/person/day

        According to an earlier problem, the amount of yw collected for composting per 100 lb of MSW gen. is
          9.94   lbs, of which   5   % comes from non residential areas
        Per capita res. yw coll. = per capita MSW gen. x frac. yw collected for compost x frac. yw from res.
        =   5.8   x   0.099367   x   0.95
        =   0.55   lb/person/day

b. Estimate the participation rate if participants set out   95   % of the yard waste they generate.
        PR =   per capita res. yw coll. / (per capita res. yw gen. x recovery rate of participants)
        PR =   0.55   / (0.91   x   0.95   )

           =   63   %

c. Determine the average weight and volume of yard waste and the number of units (bags,
cans, and/or bundles) set out at each set-out by a participating house if the set-out rate (SOR) is
   20   25   30   35   40   percent. Assume a unit is
   4   cu-ft and the specific weight of yard waste is   170   lb/cu-yd.

SOR	1	2	3
%	pounds	cu-ft	#
20	63.4	10.1	2.5
25	50.7	8.1	2.0
30	42.3	6.7	1.7
35	36.2	5.8	1.4
40	31.7	5.0	1.3

        Calculation
column   description
   1   Average weight of set out = per capita res. yd coll. (for compost) x persons/house x days/coll. period / SOR
   2   Average volume of set out = Average weight / specific weight
   3   Average number of units of set out = average volume / volume per unit

d. Determine tp for the SORs used in part c, given the relationships presented below.

tp = n x RT / (60 x NOR)   n = 2   NOR = 28787.88

RT = TT + CT + WT   (all in seconds)

CT = SOR x NOR (10   +   13   x ANU)

       where ANU = average number of units set out at participating houses

WT is negligable

TT is (in seconds):

SOR	TT
20	570198.1
25	588150.9
30	608819.8
35	631550.9
40	655858.8

SOR	TT	CT	WT	RT	tp
%	seconds	seconds	seconds	seconds	min./hse
20	570198.1	246090.4	0	816288.5	0.945
25	588150.9	260484.3	0	848635.2	0.983
30	608819.8	274878.3	0	883698.1	1.023
35	631550.9	289272.2	0	920823.1	1.066
40	655858.8	303666.2	0	959524.9	1.111

Calculations as described above

Using the parameters from the previous prob. (except n & tp), for H =   8   hrs, solve e-j.

Assume r =   2

SOR	Pscs	Np	Rcp	NOVf	NOVi	LR	V
%	hr	hse/rt	rt/prd	#	#	wd/clpr	cu-yd
1	2	3	4	5	6	7	8
20	2.4	298.4	96.5	9.6	10.0	89	11.1
25	2.4	287.0	100.3	10.0	11.0	92	10.7
30	2.4	275.6	104.5	10.4	11.0	96	10.3
35	2.4	264.5	108.8	10.9	11.0	100	9.9
40	2.4	253.8	113.4	11.3	12.0	104	9.5

Calculations

column	Description
1	Set-out rate, % (given)
2	Pscs = [H(1-W)-(t1+t2)]/Nd - (s+h)
3	Np = 60 x Pscs x n / tp
4	Rcp = NOR / Np NOR = 28787.88
5	NOV = Rcp / (Nd x Cwp) Cwp = 5
6	column 5 rounded up
7	LR = {n [Rcp x Pscs + Rcpi (s + h) + Cwp (t1 + t2)] x 7}/[(1 - W) x H x Cp)]
8	V = volume per participating house x Np x SOR / r

    where volume per part. hse. = volume set out at each set-out by participating houses