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Suggested Solution for Case Study 1

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1. (a) If we can only hire new full-time agents, the minimum total wages is 68000. We will hire 40 new full-time agents. The agent schedule is as below:

off days of full-time agents

off days	number of full-time agents
12	100
23	40
45	190
67	10
total	**340**

the number of full-time agents in each shift on each day

shift/day	1	2	3	4	5	6	7
1	110	110	150	100	70	160	200
2	90	60	100	20	60	120	100
3	40	30	50	30	20	50	30
total	240	200	300	150	150	330	330

(b) If we can only hire new part-time agents, the minimum total wages is 67200. We will hire 120 new part-time agents. The agent schedule is as below:

off days of full-time agents

off days	number of full-time agents
12	130
17	20
45	150
total	**300**

the number of full-time agents in each shift on each day

shift/day	1	2	3	4	5	6	7
1	20	80	150	100	70	130	150
2	90	60	100	20	60	120	100
3	40	30	50	30	20	50	30
total	150	170	300	150	150	300	280

the number of part-time agents in each shift on each day

shift/day	1	2	3	4	5	6	7
1	90	0	0	0	0	30	0
2	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0
						total	**120**

(c) If we can hire new full-time agents or part-time agents, the minimum total wages is 67200. We will hire no new full-time agent and 120 new part-time agents. The agent schedule is the same as (b).

(d) If we can hire new full-time agents and part-time agents, the minimum total wages is 369600. The details of agents we hire are as below: [1]

off days of full-time agents

off days	number of full-time agents			
	IEDO	ANTS	SVVRL	KMM
12	64	57	50	117
17	35	100	30	80
23	5	130	70	40
34	0	0	10	7
45	202	74	80	77
56	0	0	10	0
67	0	0	60	97
total	**306**	**361**	**310**	**418**

[1] The answer here is obtained by linear programming and we round up the number. It is actually required to use integer programming to obtain the optimal solution.

the number of agents in each group in each shift on each day

day	shift	Group IEDO	
		task IEDO	part-time
1	1	70	90
1	2	67	0
1	3	70	0
2	1	117	0
2	2	80	0
2	3	40	0
3	1	131	0
3	2	140	0
3	3	30	0
4	1	0	0
4	2	104	7
4	3	0	20
5	1	24	0
5	2	0	0
5	3	80	0
6	1	146	35
6	2	160	0
6	3	0	40
7	1	101	0
7	2	120	0
7	3	50	0
		total	**192**

day	shift	Group ANTS	
		task ANTS	task IEDO
1	1	80	0
1	2	40	34
1	3	50	0
2	1	60	4
2	2	40	0
2	3	70	0
3	1	101	0
3	2	50	0
3	3	80	0
4	1	70	67
4	2	50	0
4	3	100	0
5	1	60	27
5	2	60	60
5	3	80	0
6	1	111	0
6	2	100	0
6	3	150	0
7	1	91	0
7	2	80	0
7	3	90	0

day	shift	Group SVVRL	
		task SVVRL	task IEDO
1	1	70	0
1	2	80	0
1	3	80	0
2	1	70	0
2	2	70	0
2	3	50	0
3	1	110	0
3	2	40	0
3	3	80	0
4	1	80	0
4	2	50	0
4	3	90	0
5	1	100	0
5	2	80	0
5	3	40	0
6	1	70	0
6	2	90	0
6	3	80	0
7	1	90	0
7	2	70	0
7	3	60	0

day	shift	Group KMM	
		task KMM	task IEDO
1	1	71	0
1	2	90	0
1	3	60	0
2	1	101	0
2	2	80	0
2	3	80	0
3	1	121	0
3	2	110	0
3	3	140	0
4	1	130	34
4	2	80	0
4	3	90	0
5	1	121	0
5	2	120	0
5	3	100	0
6	1	101	0
6	2	110	0
6	3	110	0
7	1	91	0
7	2	80	0
7	3	70	0

2. Omitted.