Optimization of Support Staffing at Tesla

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Time Period	Average number of calls per hour	% Spanish speaking	Number of calls from english speaker	Number of calls from spanish speaker	Number of operators needed during the shift speaking English	Number of operators needed during the shift speaking Spanish
7 AM - 9 AM	40	20%	32	8	6	2
9 AM - 11 AM	85	20%	68	17	12	3
11 AM - 1 PM	70	20%	56	14	10	3
1 PM - 3 PM	95	20%	76	19	13	4
3 PM - 5 PM	80	20%	64	16	11	3
5 PM - 7 PM	35	20%	28	7	5	2
7 PM - 9 PM	10	20%	8	2	2	1

Underlying Assumptions:

➢ Call Volume: The number of calls the call center is expected to receive every hour.
➢ Spanish-speaking Call Volume: 20% of the total call volume, assuming that the percentage of Spanish-speaking callers remains constant throughout the day.
➢ English-speaking Call Volume: 80% of the total call volume, assuming that the percentage of English-speaking callers remains constant throughout the day.
➢ Operator Capacity: Each operator can handle six calls per hour, so twelve calls in a two-hour shift.
➢ The operators are either Spanish-speaking or English-speaking, not bilingual (for questions 1 and 2).
➢ Staffing needs to be in whole numbers as we can't hire fractions of a person.
➢ To determine the number of operators needed, we need to divide the call volume by the operator capacity. We do this separately for both Spanish and English-speaking callers and round up to the nearest whole number.
➢ The optimization decision variables should be a positive number.

a) How many full-time English-speaking agents, full-time Spanish-speaking agents, and part-time agents should Alex hire for each 2-hour shift to minimize operating costs while attending to all calls? (Please round each number to the nearest integer.)

full_time_english_7_9	full_time_spanish_7_9	full_time_english_9_11
7	2	13
full_time_spanish_9_11	full_time_english_11_1	full_time_spanish_11_1
3	4	2
full_time_english_1_3	full_time_spanish_1_3	full_time_english_3_5
1	2	2
full_time_spanish_3_5	part_time_english_3_5	part_time_english_5_7
2	6	1

b) What is the minimum cost for the optimization model to assist Alex's decision in hiring all agents that she needs? (Please round to two decimal places, e.g., 123.45.)

Minimum Cost for the Optimization Model: $ 4937.14

Due to a preference among full-time agents to avoid late evening shifts, Alex can find only one qualified English-speaking agent willing to start work at 1 P.M. and 3 P.M. Given this new constraint:

c) How many full-time English-speaking agents, full-time Spanish-speaking agents, and part-time agents should Alex hire for each 2-hour shift to minimize operating costs while attending to all calls? (Please round each number to the nearest integer.)

full_time_english_7_9	full_time_spanish_7_9	full_time_english_9_11
6	2	13
full_time_spanish_9_11	full_time_english_11_1	full_time_spanish_11_1
3	4	2
full_time_english_1_3	full_time_spanish_1_3	full_time_english_3_5
1	2	3
full_time_spanish_3_5	part_time_english_3_5	part_time_english_5_7
2	6	1

d) What is the minimum cost for the optimization model to assist Alex's decision in hiring all agents that she needs? (Please round to two decimal places.)

Minimum Cost for the Optimization Model: $ 4943.49

Alex is now exploring the possibility of hiring bilingual agents instead of monolingual agents. If all agents are bilingual:

e) How many full-time and part-time agents should Alex hire for each 2-hour shift to minimize operating costs while attending to all calls? (Please round each number to the nearest integer.)

full_time_7_9	full_time_9_11	full_time_11_1
8	16	6
full_time_1_3	full_time_3_5	part_time_3_5
2	4	6
part_time_5_7		
1		

f) What is the minimum cost for the optimization model to assist Alex's decision in hiring all agents that she needs? (Please round to two decimal places.)

Minimum Cost for the Optimization Model (Bilingual): $ 4936.78

g) What is the maximum percentage increase in the hourly wage rate that Alex can offer to bilingual agents over monolingual agents without increasing the total operating costs? (Please round to one decimal place, e.g., 8.7%.)

Maximum Percentage Increase in Hourly Wage Rate for Bilingual Agents: 17.4%