Schedule Design Examples

To give you a better understanding of the schedule design process, we decided to post a few examples. Even though these situations are likely to be different from yours, the basic steps involved are the same:

1.   Determine requirements.
2.   Test feasibility.
3.   Develop strategy.
4.   Design options.

Let's take a look at each step in more detail, starting with the first example.

Example #1

Step 1: Determine Requirements

The first step is to gather information on the client's requirements and resources.

- Hours of operation = 24/7
- Coverage requirements = 18 on days and 12 on nights
- Staff size = 60 full-time employees + casual workers
- Shift length = 12 hours
- Schedule format = rotating shifts
- Pay week = Sunday to Saturday
- Average weekly work hours = 40 over multiple weeks (contractual requirement)
- Other = use casual staff to cover open shifts and absences
- Other = maximum of 4 consecutive shifts
- Current schedule = 12 on days and 48 on the attached rotating shift schedule
- Goal is to have all 60 employees rotate to reduce the number of night shifts

Step 2: Test Feasibility

The second step is to make sure the organization has sufficient resources to achieve its requirements. This is done by computing the total required hours of coverage each week.

- 18 people * 12 hours/day * 7 days/week = 1,512hours/week
- 12 people * 12 hours/day * 7 days/week = 1,008 hours/week
- 1,512 hours/week + 1,008 hours/week = 2,520 hours/week

When the hours of coverage are divided by the staff size, this gives the average hours of work.

- 2,520 hours/week / 60 staff = 42 hours/week

In this case, the organization is required by contract to limit the average weekly hours to 40. This means more employees will be needed as shown below.

- 2,520 hours/week / 40 hours/week = 63 full-time employees

Client will use casual staff to make up the 3 person shortfall, so the resources are adequate for the coverage requirements.

Step 3: Develop Strategy

The starting point for all schedule design projects is the coverage requirements. In this case, 18-person coverage is needed on day shift and 12-person coverage is needed on night shift. Since a normal 4-crew rotating shift schedule would produce the same coverage on both shifts, these schedules will have to use more than 4 crews. There are several possibilities that will match the coverage proportions on each shift:

1. 36 employees (and weeks) on day shift + 24 employees (and weeks) on night shift
2. 18 crews (and weeks) on day shift + 12 crews (and weeks) on night shift (crew size = 2)
3. 12 crews (and weeks) on day shift + 8 crews (and weeks) on night shift (crew size = 3)
4. 6 crews (and weeks) on day shift + 4 crews (and weeks) on night shift (crew size = 6)

The next part of the strategy is to decide what common 12-hour patterns might be adapted to the crew configurations listed above. Since the client was already using a modified 4-on-4-off pattern, we decided to start with that. Although most employees prefer a slow rotation between the two shifts, this organization was used to a fast rotation, so we decided to show examples of both fast and slow rotations.

This strategy will allow us to create several different options for the client. In this example we will only show one crew configuration (#3 above) and two different options (slow and fast shift rotation).

Option #1: 4-on-4-off slow rotation (20 crews)

Crew / Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Hours
A / Week 1	D12	D12	D12	D12	-	-	-	36
B / Week 2	-	D12	D12	D12	D12	-	-	48
C / Week 3	-	-	D12	D12	D12	D12	-	36
D / Week 4	-	-	-	D12	D12	D12	D12	48
E / Week 5	-	-	-	-	D12	D12	D12	36
F / Week 6	D12	-	-	-	-	D12	D12	36
G / Week 7	D12	D12	-	-	-	-	D12	36
H / Week 8	D12	D12	D12	-	-	-	-	36
I / Week 9	D12	D12	D12	-	-	-	-	36
J / Week 10	-	-	-	-	D12	D12	D12	36
K / Week 11	-	-	D12	D12	-	D12	D12	48
L / Week 12	D12	D12	-	D12	D12	-	-	48
M / Week 13	N12	N12	N12	N12	-	-	-	48
N / Week 14	-	N12	N12	N12	N12	-	-	36
O / Week 15	-	-	N12	N12	N12	N12	-	48
P / Week 16	-	-	-	N12	N12	N12	N12	36
Q / Week 17	-	-	-	-	N12	N12	N12	36
R / Week 18	N12	-	-	-	-	N12	N12	36
S / Week 19	N12	N12	-	-	-	-	N12	36
T / Week 20	N12	N12	N12	-	-	-	-	36
							Average	39.6

Key:			Schedule Features:				
D12 = 12-hour day shift			Weekends off = 8 every 20 weeks				
N12 = 12-hour night shift			Max days worked = 4				
Shift assigned to casual worker			Max days off = 8				
Crew size = 3			Min days off = 1				

Coverage:	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Days	18	18	18	18	18	18	18
Nights	12	12	12	12	12	12	12

Explanation:

The way the schedule works is that the 20 crews of 3 employees each are initially assigned to a week in the schedule. When they finish that first week, they rotate down to the next week of the schedule. They continue doing this until they finish the 20th week, after which they rotate up to the first week.

This is a traditional 4-on-4-off schedule that has been modified in three ways. Instead of a 4-crew schedule, it has been expanded to 20 crews. This was done to match the uneven coverage requirements on the two shifts.

The 4-on-4-off pattern is normally 8 weeks per shift. We were able to use this for the first 8 weeks of the schedule and the last 8 weeks of the schedule. Weeks 9 through 12 had to be tweaked to achieve the desired coverage.

To reduce the average hours of work from 42 to 40, several shifts were given to casual employees. These shifts are highlighted in yellow.

Option #2: 4-on-4-off fast rotation (20 crews)

Crew / Week	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Hours
A / Week 1	D12	D12	N12	N12	-	-	-	36
B / Week 2	-	D12	D12	N12	N12	-	-	48
C / Week 3	-	-	D12	D12	N12	N12	-	36
D / Week 4	-	-	-	D12	D12	N12	N12	48
E / Week 5	-	-	-	-	D12	D12	N12	36
F / Week 6	N12	-	-	-	-	D12	D12	36
G / Week 7	N12	N12	-	-	-	-	D12	36
H / Week 8	D12	N12	N12	-	-	-	-	36
I / Week 9	D12	D12	D12	-	-	-	-	36
J / Week 10	-	-	-	-	D12	D12	D12	36
K / Week 11	-	-	D12	D12	-	D12	D12	48
L / Week 12	D12	D12	-	D12	D12	-	-	48
M / Week 13	D12	D12	N12	N12	-	-	-	48
N / Week 14	-	D12	D12	N12	N12	-	-	36
O / Week 15	-	-	D12	D12	N12	N12	-	48
P / Week 16	-	-	-	D12	D12	N12	N12	36
Q / Week 17	-	-	-	-	D12	D12	N12	36
R / Week 18	N12	-	-	-	-	D12	D12	36
S / Week 19	N12	N12	-	-	-	-	D12	36
T / Week 20	D12	N12	N12	-	-	-	-	36
							Average	39.6

Key:				Schedule Features:			
D12 = 12-hour day shift				Weekends off = 8 every 20 weeks			
N12 = 12-hour night shift				Max days worked = 4			
Shift assigned to casual worker				Max days off = 8			
Crew size = 3				Min days off = 1			

Coverage:	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Days	18	18	18	18	18	18	18
Nights	12	12	12	12	12	12	12

Explanation:

Since the organization was already working a rapid-rotating 12-hour schedule, it seemed appropriate to include a similar option. Although most employees prefer a slower rotation, they also tend to stay close to what they are most familiar with.

We matched the current schedule by having 2 day shifts followed by 2 night shifts. We could not continue this pattern through the entire 20 weeks since we needed more day shifts than night shifts.

As with the slow-rotating schedule, the pattern begins with a standard 4-on-4-off. To make this pattern work for this particular schedule, however, it was necessary to alter the pattern in weeks 9 through 12.

To keep the average hours at 40 per week, several shifts were assigned to casual workers. These shifts are highlighted in yellow.

Example #2

Step 1: Determine Requirements

The first step is to gather information on the client's requirements and resources.

- Hours of operation = 8/7 (single 8-hour shift for 7 days a week)
- Coverage requirements = 6 on weekdays and 4 on weekends
- Staff size = 8 full-time employees
- Shift length = 8 hours
- Pay week = Saturday to Friday
- Maximum weekly work hours = 40

Step 2: Test Feasibility

The second step is to make sure the organization has sufficient resources to achieve its requirements. This is done by computing the total required hours of coverage each week.

- 6 people * 8 hours/day * 5 days/week = 240 hours/week
- 4 people * 8 hours/day * 2 days/week = 64 hours/week
- 240 hours/week + 64 hours/week = 304 hours/week

When the hours of coverage are divided by the staff size, this gives the average hours of work.

- 304 hours/week / 8 staff = 38 hours/week

We can always add another shift to make all the work weeks 40 hours long.

Step 3: Develop Strategy

The starting point for all schedule design projects is the coverage requirements. In this case, there is only one shift, but the coverage varies from 6 on weekdays to 4 on the weekends. There are two broad ways to approach this schedule design:

1. 8 employees (and weeks)
2. 4 crews (and weeks)

There aren't too many patterns that will work with the variable coverage requirements. Therefore we decided to show examples with and without crews (#1 and #2 above). Since the coverage does not require 40 hours a week, we added shifts to bring every week up to 40.

Option #1: 7 Days in a Row (4 crews)

Crew / Week	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Hours
A / Week 1	-	-	d8	d8	d8	d8	d8	40
B / Week 2	-	-	d8	d8	d8	d8	d8	40
C / Week 3	d8	d8	-	-	d8	d8	d8	40
D / Week 4	d8	d8	d8	d8	d8	-	-	40

Key:			Schedule Features:		
d8 = 8-hour day shift			Weekends off = 2 every 4 weeks		
			Max. days worked = 8		
Crew Size: 2			Max. days off = 4		

Coverage	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Days	4	4	6	6	6	6	6

Explanation:

The way the schedule works is that the 4 crews of 2 employees each are initially assigned to a week in the schedule. When they finish that first week, they rotate down to the next week of the schedule. They continue doing this until they finish the 4th week, after which they rotate up to the first week.

This is a traditional 7 day-in-row schedule that has been modified in two ways. The first was to tweak the pattern to match the coverage requirements. This was done by scheduling only Mon-Fri in the first week.

The second change was to add a shift on Wed of Week 4 to have 40 hours of work that week. It's not needed for coverage purposes, so 2 extra people will be working every Wednesday. The shift is highlighted in yellow.

Option #2: 3,4&5 Days in a Row (4 crews)

Crew / Week	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Hours
A / Week 1	d8	d8	d8	d8	-	-	d8	40
B / Week 2	d8	d8	-	-	d8	d8	d8	40
C / Week 3	-	-	d8	d8	d8	d8	d8	40
D / Week 4	-	d8	d8	d8	d8	d8	-	40

Key:			Schedule Features:		
d8 = 8-hour day shift			Weekends off = 1 every 4 weeks		
			Max. days worked = 5		
Crew Size: 2			Max. days off = 2		

Coverage	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Days	4	4	6	6	6	6	6

Explanation:

The way the schedule works is that the 4 crews of 2 employees each are initially assigned to a week in the schedule. When they finish that first week, they rotate down to the next week of the schedule. They continue doing this until they finish the 4th week, after which they rotate up to the first week.

Since many employees don't like to work 7 days in a row, we tried to create a pattern with fewer days of work. This pattern was created from scratch.

As with Option #1 we added a shift on Sun of Week 4 to have 40 hours of work that week. It's not needed for coverage purposes, so 2 extra people will be working every Sunday. The shift is highlighted in yellow.

The downside is that this pattern only has one full weekend off (whereas Option #1 has 2 weekends off). We couldn't move the extra day to Friday because that would have required employees to work 9 days in a row (when they rotated up to Week 1 of the schedule).

Option #3: 7 Days in a Row

Emp / Week	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Hours
A / Week1	-	-	d8	d8	d8	d8	d8	40
B / Week 2	d8	d8	-	-	d8	d8	d8	40
C / Week 3	-	-	d8	d8	d8	d8	d8	40
D / Week 4	d8	d8	-	-	d8	d8	d8	40
E / Week 5	d8	d8	d8	d8	-	-	d8	40
F / Week 6	d8	d8	d8	d8	d8	-	-	40
G / Week 7	-	-	d8	d8	d8	d8	d8	40
H / Week 8	-	-	d8	d8	d8	d8	d8	40

Key:

d8 = 8-hour day shift

Schedule Features:

Weekends off = 4 every 8 weeks

Max. days worked = 7

Max. days off = 4

Coverage	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Days	4	4	6	6	6	6	6

Explanation:

The way the schedule works is that the 8 employees each are initially assigned to a week in the schedule. When they finish that first week, they rotate down to the next week of the schedule. They continue doing this until they finish the 8th week, after which they rotate up to the first week.

This is a traditional 7 day-in-row schedule that has been modified in two ways. The first was to tweak the pattern to match the coverage requirements.

The second change was to add a shift on Wed of Week 6 and Fri of Week 5 to have 40 hours of work those weeks. It's not needed for coverage purposes, so 1 extra person will be working every Wednesday and Friday. The shifts are highlighted in yellow.

Option #4: 3,4&5 Days in a Row

Emp / Week	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Hours
A / Week1	d8	d8	d8	d8	-	-	d8	40
B / Week 2	d8	d8	-	-	d8	d8	d8	40
C / Week 3	-	-	d8	d8	d8	d8	d8	40
D / Week 4	-	d8	d8	d8	d8	d8	-	40
E / Week 5	d8	d8	d8	d8	-	-	d8	40
F / Week 6	d8	d8	-	-	d8	d8	d8	40
G / Week 7	-	-	d8	d8	d8	d8	d8	40
H / Week 8	-	d8	d8	d8	d8	d8	-	40

Key:			Schedule Features:				
d8 = 8-hour day shift			Weekends off = 2 every 8 weeks				
			Max. days worked = 5				
			Max. days off = 2				

Coverage	Sat	Sun	Mon	Tue	Wed	Thu	Fri
Days	4	4	6	6	6	6	6

Explanation:

The way the schedule works is that the 8 employees each are initially assigned to a week in the schedule. When they finish that first week, they rotate down to the next week of the schedule. They continue doing this until they finish the 8th week, after which they rotate up to the first week.

Since many employees don't like to work 7 days in a row, we tried to create a pattern with fewer days of work. This pattern was created from scratch.

As with other options we added a shift on Sun of Week 4 and Week 8 to have 40 hours of work those week. It's not needed for coverage purposes, so 2 extra people will be working every Sunday. The shift is highlighted in yellow.

The downside is that this pattern only has two full weekends off (whereas Option #3 has 2 weekends off). We couldn't move the extra day to Friday because that would have required employees to work 9 days in a row.

Summary

Both of these examples followed the same 4-step process. We identified the client's requirements. We tested the feasibility of the client's resources to achieve their requirements. We came up with the best approach with regard to number of crews and schedule weeks, patterns that might be adapted, and other adjustments needed to match the requirements. In addition, all of the schedules were built around the client's pay week.

Sometimes the situations are not as challenging as these. Sometimes they are infeasible or impossible to satisfy. We immediately inform the client and leave it up to them to either increase the resources (hire more staff or build overtime into the schedule) or relax the requirements (lower the coverage or eliminate some of the restrictions).