Crew Scheduling System Reports

Task Description

TECHNICAL AUDITION

Below is your audition scenario. Please prepare a solution to the problem described. Please arrive ready to present your solution, in whatever fashion you feel most comfortable (e.g. whiteboard, written design, UML, PowerPoint, pseudo code, actual code), to a panel of 3 to 4 interviewers. Once you have presented your solution, the interviewers will ask questions and provide additional requirements that you will have to incorporate into your design on the fly. This process gives us a chance to see how you solve problems, how advanced your design skills are, how well you present to a group, and how well you think on your feet. The technical audition will last approximately one hour. Please let us know if you have any questions before the interview.

DESIGNING AN ARCHITECTURE FOR WORLDWIDE CREW SCHEDULING

Consider an application to handle the scheduling of airline crews for commercial flights. This application is used by airline station managers to ensure that every departing flight has two pilots (with at least one pilot being a "senior" or "captain") and a cabin crew of three people where one of the cabin crew is a senior level flight attendant.
Each airline station manager is situated at an airport with varying levels and quality of Internet access. For example, airline station managers located in New York City have access to reliable, high-speed Internet access while station managers at smaller airports such as Burlington, Vermont may have slow or unreliable access.
For each human, the application will track the following metadata: (at a minimum)
Full name (first and last)
Social security number
Number of hours flown in the last 40 hours
Number of hours flown in the last 7 days
Number of hours flown in the last 28 days
Crew type (1 = flight attendant / 2 = pilot)
Crew seniority (1 = trainee / 2 = journeyman / 3 = senior [i.e. captain or senior F.A])
For each flight requiring a crew, the application will track the following metadata: (at a minimum)
Airline
Flight number
Departure city
Destination city
Flight duration
NOTE: The metadata listed above is intentionally incomplete. As in real life, new data fields (or even whole tables) may need to be incorporated into the database to achieve the design goals of the application.
The minimum viable product for the first release of this application should be able to do the following:
Allow for operational redundancy of the application by deployment to multiple servers.
Allow for station managers to run a query to schedule a crew for a departing flight. The ultimate goal is both regulatory compliance to ensure crews do not exceed flight time limitations and fairness to ensure that the work is spread as evenly as practical across all available flight personnel in a particular location. REMEMBER: crew can only be scheduled to work flights that depart from the same city in which they are currently located.
Allow for flight operations department to run a report showing all crew members on planes currently in flight.
Allow for government compliance department to run a report showing all crew members who either have exceeded or are in danger of exceeding their work hour limitations per 14 CFR Part 117 and 14 CFR Part 121.467. These limits for the purpose of this audition can be summed up as:
No pilot may fly more than 100 total hours in the last 672 hours
No pilot may fly more than 1,000 total hours in the last 365 days
No pilot may fly more than 60 hours in the last 168 consecutive hours
No pilot may fly more than 190 hours in the last 672 consecutive hours
No flight attendant may be on domestic flight duty for more than 14 consecutive hours
No flight attendant may be on international flight duty for more then 20 consecutive hours

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All flight attendant require at least 9 consecutive hours between flights

Allow for human resources to run a report listing the number of hours worked per month (and when) on a per employee basis to support payroll.

Design the database to implement this application, including any tables, indexes, views, triggers, and constraints that may be needed. Write the appropriate T-SQL queries to implement the four reports listed above, and provide a logical diagram depicting how the servers supporting this application will be configured to support 99.9999% up time.

Remember to consider the security requirements of each piece of information stored in the database.

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This report shows all crew members currently on planes in flight, including their flight details and roles.

Report 1: Crew currently in flight

No crew currently in flight.

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This report lists crew members who have exceeded or are at risk of exceeding their work hour limitations as per regulatory requirements.

Report 2: Crew exceeding hour limits

No crew exceeding hour limits.

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This report provides a summary of hours worked per month by each crew member to support payroll processing.

Report 3: Monthly hours worked by crew

Crew	First Name	Last Name	Year	Month	Monthly Hours	Seniority
1	John	Doe	2024	6	2.00	Senior
1	John	Doe	2024	11	3.33	Senior
1	John	Doe	2025	9	15.00	Senior
2	Jane	Smith	2024	2	3.00	Journeyman
2	Jane	Smith	2024	7	4.83	Journeyman
2	Jane	Smith	2024	12	4.00	Journeyman
2	Jane	Smith	2025	9	18.00	Journeyman
3	Mike	Johnson	2024	3	2.50	Trainee
3	Mike	Johnson	2024	8	1.67	Trainee
3	Mike	Johnson	2025	1	5.33	Trainee
3	Mike	Johnson	2025	10	12.00	Trainee
4	Emily	Davis	2024	4	1.50	Senior
4	Emily	Davis	2024	9	5.33	Senior
4	Emily	Davis	2024	11	3.33	Senior
4	Emily	Davis	2025	2	2.67	Senior
4	Emily	Davis	2025	10	19.00	Senior
5	David	Wilson	2024	5	5.00	Journeyman
5	David	Wilson	2024	10	4.50	Journeyman
5	David	Wilson	2025	3	4.17	Journeyman
5	David	Wilson	2025	11	16.00	Journeyman
6	Sarah	Brown	2024	1	8.17	Trainee
6	Sarah	Brown	2024	6	4.17	Trainee
6	Sarah	Brown	2025	4	2.17	Trainee
7	Chris	Miller	2024	2	5.50	Senior
7	Chris	Miller	2024	7	2.33	Senior
7	Chris	Miller	2025	5	4.67	Senior
8	Anna	Garcia	2024	3	6.17	Journeyman
8	Anna	Garcia	2024	8	2.67	Journeyman
8	Anna	Garcia	2025	6	2.50	Journeyman
9	Tom	Rodriguez	2024	4	8.33	Trainee
9	Tom	Rodriguez	2024	9	1.83	Trainee
9	Tom	Rodriguez	2025	7	5.00	Trainee
10	Lisa	Martinez	2024	5	8.83	Senior
10	Lisa	Martinez	2024	10	1.67	Senior
10	Lisa	Martinez	2025	8	2.83	Senior
11	Paul	Hernandez	2024	6	2.00	Journeyman

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11	Paul	Hernandez	2024	11	3.33	Journeyman
11	Paul	Hernandez	2025	9	15.00	Journeyman
12	Karen	Lopez	2024	2	3.00	Trainee
12	Karen	Lopez	2024	7	4.83	Trainee
12	Karen	Lopez	2024	12	4.00	Trainee
12	Karen	Lopez	2025	9	18.00	Trainee
13	Mark	Gonzalez	2024	3	2.50	Senior
13	Mark	Gonzalez	2024	8	1.67	Senior
13	Mark	Gonzalez	2025	1	5.33	Senior
13	Mark	Gonzalez	2025	10	12.00	Senior
14	Rachel	Perez	2024	4	1.50	Journeyman
14	Rachel	Perez	2024	9	5.33	Journeyman
14	Rachel	Perez	2025	2	2.67	Journeyman
14	Rachel	Perez	2025	10	19.00	Journeyman
15	Steve	Sanchez	2024	5	5.00	Trainee
15	Steve	Sanchez	2024	10	4.50	Trainee
15	Steve	Sanchez	2025	3	4.17	Trainee
15	Steve	Sanchez	2025	11	16.00	Trainee
16	Laura	Ramirez	2024	1	8.17	Senior
16	Laura	Ramirez	2024	6	4.17	Senior
16	Laura	Ramirez	2025	4	2.17	Senior
17	Kevin	Torres	2024	2	5.50	Journeyman
17	Kevin	Torres	2024	7	2.33	Journeyman
17	Kevin	Torres	2025	5	4.67	Journeyman
18	Jessica	Flores	2024	3	6.17	Trainee
18	Jessica	Flores	2024	8	2.67	Trainee
18	Jessica	Flores	2025	6	2.50	Trainee
19	Brian	Rivera	2024	4	8.33	Senior
19	Brian	Rivera	2024	9	1.83	Senior
19	Brian	Rivera	2025	7	5.00	Senior
20	Amanda	Gomez	2024	5	8.83	Journeyman
20	Amanda	Gomez	2024	10	1.67	Journeyman
20	Amanda	Gomez	2025	8	2.83	Journeyman
21	Nicole	Diaz	2024	6	2.00	Senior
21	Nicole	Diaz	2024	11	3.33	Senior
21	Nicole	Diaz	2025	9	15.00	Senior
22	Daniel	Morales	2024	2	3.00	Journeyman
22	Daniel	Morales	2024	7	4.83	Journeyman
22	Daniel	Morales	2024	12	4.00	Journeyman
22	Daniel	Morales	2025	9	18.00	Journeyman
23	Ashley	Ortiz	2024	3	2.50	Trainee

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23	Ashley	Ortiz	2024	8	1.67	Trainee
23	Ashley	Ortiz	2025	1	5.33	Trainee
23	Ashley	Ortiz	2025	10	12.00	Trainee
24	Tyler	Gutierrez	2024	4	1.50	Senior
24	Tyler	Gutierrez	2024	9	5.33	Senior
24	Tyler	Gutierrez	2025	2	2.67	Senior
24	Tyler	Gutierrez	2025	10	19.00	Senior
25	Megan	Chavez	2024	5	5.00	Journeyman
25	Megan	Chavez	2024	10	4.50	Journeyman
25	Megan	Chavez	2025	3	4.17	Journeyman
25	Megan	Chavez	2025	11	16.00	Journeyman
26	Justin	Ramos	2024	1	8.17	Trainee
26	Justin	Ramos	2024	6	4.17	Trainee
26	Justin	Ramos	2025	4	2.17	Trainee
27	Hannah	Guzman	2024	2	5.50	Senior
27	Hannah	Guzman	2024	7	2.33	Senior
27	Hannah	Guzman	2025	5	4.67	Senior
28	Brandon	Castillo	2024	3	6.17	Journeyman
28	Brandon	Castillo	2024	8	2.67	Journeyman
28	Brandon	Castillo	2025	6	2.50	Journeyman
29	Samantha	Jimenez	2024	4	8.33	Trainee
29	Samantha	Jimenez	2024	9	1.83	Trainee
29	Samantha	Jimenez	2025	7	5.00	Trainee
30	Austin	Moreno	2024	5	8.83	Senior
30	Austin	Moreno	2024	10	1.67	Senior
30	Austin	Moreno	2025	8	2.83	Senior
31	Taylor	Vargas	2024	6	2.00	Journeyman
31	Taylor	Vargas	2024	11	3.33	Journeyman
31	Taylor	Vargas	2025	9	15.00	Journeyman
32	Madison	Romero	2024	2	3.00	Trainee
32	Madison	Romero	2024	7	4.83	Trainee
32	Madison	Romero	2024	12	4.00	Trainee
32	Madison	Romero	2025	9	18.00	Trainee
33	Jordan	Herrera	2024	3	2.50	Senior
33	Jordan	Herrera	2024	8	1.67	Senior
33	Jordan	Herrera	2025	1	5.33	Senior
33	Jordan	Herrera	2025	10	12.00	Senior
34	Alexis	Medina	2024	4	1.50	Journeyman
34	Alexis	Medina	2024	9	5.33	Journeyman
34	Alexis	Medina	2025	2	2.67	Journeyman
34	Alexis	Medina	2025	10	19.00	Journeyman

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35	Cameron	Cortes	2024	5	5.00	Trainee
35	Cameron	Cortes	2024	10	4.50	Trainee
35	Cameron	Cortes	2025	3	4.17	Trainee
35	Cameron	Cortes	2025	11	16.00	Trainee
36	Kayla	Santiago	2024	1	8.17	Senior
36	Kayla	Santiago	2024	6	4.17	Senior
36	Kayla	Santiago	2025	4	2.17	Senior
37	Dylan	Luna	2024	2	5.50	Journeyman
37	Dylan	Luna	2024	7	2.33	Journeyman
37	Dylan	Luna	2025	5	4.67	Journeyman
38	Hailey	Ortega	2024	3	6.17	Trainee
38	Hailey	Ortega	2024	8	2.67	Trainee
38	Hailey	Ortega	2025	6	2.50	Trainee
39	Ethan	Delgado	2024	4	8.33	Senior
39	Ethan	Delgado	2024	9	1.83	Senior
39	Ethan	Delgado	2025	7	5.00	Senior
40	Avery	Castro	2024	5	8.83	Journeyman
40	Avery	Castro	2024	10	1.67	Journeyman
40	Avery	Castro	2025	8	2.83	Journeyman
41	Nathan	Soto	2024	6	2.00	Trainee
41	Nathan	Soto	2024	11	3.33	Trainee
41	Nathan	Soto	2025	9	15.00	Trainee
42	Isabella	Mendoza	2024	2	3.00	Senior
42	Isabella	Mendoza	2024	7	4.83	Senior
42	Isabella	Mendoza	2024	12	4.00	Senior
42	Isabella	Mendoza	2025	9	18.00	Senior
43	Mason	Silva	2024	3	2.50	Journeyman
43	Mason	Silva	2024	8	1.67	Journeyman
43	Mason	Silva	2025	1	5.33	Journeyman
43	Mason	Silva	2025	10	12.00	Journeyman
44	Sophia	Pena	2024	4	1.50	Trainee
44	Sophia	Pena	2024	9	5.33	Trainee
44	Sophia	Pena	2025	2	2.67	Trainee
44	Sophia	Pena	2025	10	19.00	Trainee
45	Logan	Reyes	2024	5	5.00	Senior
45	Logan	Reyes	2024	10	4.50	Senior
45	Logan	Reyes	2025	3	4.17	Senior
45	Logan	Reyes	2025	11	16.00	Senior
46	Ava	Cruz	2024	1	8.17	Journeyman
46	Ava	Cruz	2024	6	4.17	Journeyman
46	Ava	Cruz	2025	4	2.17	Journeyman

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47	Jackson	Fernandez	2024	2	5.50	Trainee
47	Jackson	Fernandez	2024	7	2.33	Trainee
47	Jackson	Fernandez	2025	5	4.67	Trainee
48	Mia	Ruiz	2024	3	6.17	Senior
48	Mia	Ruiz	2024	8	2.67	Senior
48	Mia	Ruiz	2025	6	2.50	Senior
49	Liam	Alvarez	2024	4	8.33	Journeyman
49	Liam	Alvarez	2024	9	1.83	Journeyman
49	Liam	Alvarez	2025	7	5.00	Journeyman
50	Charlotte	Morales	2024	5	8.83	Trainee
50	Charlotte	Morales	2024	10	1.67	Trainee
50	Charlotte	Morales	2025	8	2.83	Trainee

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This report suggests available crew members for scheduling on a specific flight, prioritizing those with the most rest time.

Report 4: Schedule crew for flight (FlightID: 92)

No available crew found.