

Hitachi Releases Solution for Scheduling Optimal Shifts for Dozens or Hundreds of Workers

Hitachi's original CMOS Annealing computing technology that simulates quantum computing enables the quick and easy scheduling of worker's shifts to fulfill complicated workstyle desires.

Tokyo, October 19, 2020 – Hitachi, Ltd. (TSE: 6501) today announced the release of Work Shift Optimization Solution (hereinafter the "Solution") on October 19. This Solution is designed to prepare work shift schedules for dozens or hundreds of employees using Hitachi's original computing technology known as CMOS Annealing.*¹

This Solution uses Hitachi's CMOS Annealing technology, which simulates the behavior of a quantum computer*² to solve large and complicated combinatorial optimization problems. It is able to create work shift schedules that fulfill complicated conditions, such as the number of personnel required and the tasks needed in specific time slots, people's vacation requests, working frequency and commuting time. The Solution proposes large shifts with optimal assignments, comprehensively considering detailed constraints, for service centers, call centers and equivalent organizations, rather than shifts with a uniform rotation.

Prior to the release of this Solution, trials of it was carried out at several call centers of Sumitomo Mitsui Financial Group, and the practical value of the Solution was jointly verified. The trials confirmed that the Solution had a significant effect on the optimization of staff assignments. For example, it reduced the occurrences of surplus staffing by around 80% compared to a conventional work shift created manually.

Generally, where individuals work in shifts, such as service centers and call centers, managers need to create work shifts in consideration of detailed constraints, including trends in past busy seasons, the tasks to be done by individuals or teams and the wishes of these individuals. Therefore, the larger the scale of centers, the longer it takes to prepare the schedule. It is very hard for humans to prepare work shifts that fulfill all of the complicated conditions. Consequently, there are many cases where a fixed rotation is used every week. This tends to lead to problems such as a failure to flexibly respond to workers' wishes and conditions and an excess or shortage of assignments.

In addition, more and more companies are introducing a wide variety of workstyles during the COVID-19 pandemic, including work shift schedules designed to avoid close-contact settings and enable non-face-to-face working. In different business sectors, the conventional uniform work system is being revised. The importance of assigning the proper number of personnel is increasing.

The core technology of this Solution is CMOS Annealing which has been under development by Hitachi's Research and Development Group since 2015. It is a technology that quickly solves very large and complicated computational problems, called combinatorial optimization problems. It takes more time for conventional computer processing to solve large-scale problems and select an optimal solution from countless combinations, as these problems involve many variables. CMOS Annealing is able to perform the calculations at a high speed.

This Solution uses CMOS Annealing to calculate optimal solutions to large-scale problem about staff assignments in consideration of complicated constraints and conditions specific to individual workplaces. It is expected to prevent increases in cost due to overstaffing and deterioration in services due to staff shortages. When introducing the Solution, an optional feature to predict busy dates or times and future workloads based on past data is available. Because this Solution provides an environment for using the CMOS Annealing technology as

a cloud service, it does not require the customer to purchase machines or install dedicated telecommunications infrastructure. It is a semi-custom-made solution that customizes the conditions necessary for scheduling work shifts according to customer operability and actual operations. Because customers only have to enter the necessary information using a web browser, this Solution considerably reduces the workloads involved in scheduling work shifts.

Prior to the provision of this solution, Hitachi carried out a demonstration of preparation of internal work shifts using CMOS Annealing. In May 2020, when Japan was in a state of emergency due to the COVID-19 pandemic, Hitachi introduced a shift work system for around 360 researchers at the Central Research Laboratory (Kokubunji-shi, Tokyo). Because research activities require special facilities, it was decided that there would be four work shifts with different times for employees to come to work and limited equipment would be shared efficiently. There were a lot of conditions for shift arrangement, including the teams that the individual personnel worked on together, research subjects, progress of experiments, usage time of experiment equipment, desired frequency of working in the lab and commuting times. With CMOS Annealing, work shifts were effectively created for hundreds of personnel aimed at enabling employees to avoid close-contact settings, as well as closed and crowded spaces. This aided the smooth continuation of research activities while minimizing the risk of COVID-19 infection.

In a society that is adapting to a new normal, the shift to flexible workstyles is expected to leverage both working from home and at the office. Hitachi will promote this Solution as one of its Lumada^{*3} solutions that accelerate digital innovation for a wide range of businesses and operations, so that the Solution can support corporate efforts to improve people's work-life balances and enable the adoption of diverse workstyles.

In addition, Hitachi will continue to accelerate its development of CMOS Annealing technology and expand the fields covered by this solution in order to support customers' core business, such as optimization of financial instrument portfolios and the improvement of picking work in distribution warehouses.

*1 CMOS Annealing: A new type of computer developed by Hitachi to solve combinatorial optimization problems using the Ising model, describes the properties of magnetic materials.

*2 As a kind of quantum computer, there is an annealing quantum computer, or quantum annealing. It can solve combinatorial optimization problems using the Ising model, a statistical mechanic model describing the behaviors of magnetic materials. While quantum annealing is a computing technology for solving combinatorial optimization problems using quantum effects, the CMOS Annealing developed by Hitachi uses semiconductor circuits to simulate quantum annealing without quantum effects.

*3 Lumada: The name of Hitachi's advanced digital solutions and services for turning data into insights that drive digital transformation of social infrastructure.

Features of this Solution

1. Optimal personnel assignment suited to demand optimizes personnel costs and improves service quality.

Work shifts scheduled using this Solution lead to optimal staff assignments matched to demand at individual workplaces. They optimize costs and streamline operations by rectifying the excess staffing. They also assign an appropriate number of personnel to times when there is a staff shortage to ease the burdens on workers and help improve the level of service. At call centers and similar organizations, they are expected to help reduce the time that customers wait until their calls are answered and to make it easier for customers to communicate with operators.

In addition, there is an optional service available with this Solution for predicting future workloads and the number of personnel required for the workload based on records of past operations. This will open the way toward the proposal of a more accurate assessment based on data, not on the empirical knowledge of the staff members in charge.

2. Easy data entry and high-speed computing reduce the burdens of creating work shifts.

According to the customers' wishes, the conditions that are necessary for scheduling work

shifts are customized on a case-by-case basis. This semi-custom-made solution will be implemented in consideration of customer convenience and actual operations, including examination of the setting method according to each condition and verification of the effect when the setting is adopted.

With this Solution, the personnel creating work shifts only have to enter the necessary information to create work shifts. This reduces the burdens on employees in the scheduling of work shifts and enables people to use that time doing other duties. The person scheduling the work shift will enter dates, times and different conditions such as the number of staff members required on each date or at each time, workers' wishes regarding paid leave and other factors influencing scheduling. This data can be entered using a web browser, and it is not necessary to install dedicated telecommunications infrastructure or other equipment. The calculation itself will be done in tens of minutes. After the work shifts are created, they can be re-created immediately if there are any changes in conditions, such as a worker taking leave. Since it performs the calculation to produce an optimal solution from a vast number of patterns, it enables the customer to flexibly respond to workers' needs.

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About Hitachi, Ltd.

Hitachi, Ltd. (TSE: 6501), headquartered in Tokyo, Japan, is focused on its Social Innovation Business that combines information technology (IT), operational technology (OT) and products. The company's consolidated revenues for fiscal year 2019 (ended March 31, 2020) totaled 8,767.2 billion yen (\$80.4 billion), and it employed approximately 301,000 people worldwide. Hitachi drives digital innovation across five sectors - Mobility, Smart Life, Industry, Energy and IT - through Lumada, Hitachi's advanced digital solutions, services, and technologies for turning data into insights to drive digital innovation. Its purpose is to deliver solutions that increase social, environmental and economic value for its customers. For more information on Hitachi, please visit the company's website at <https://www.hitachi.com>.

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