UNIVERSITY OF MANNHEIM
Business School

CHAIR OF SERVICE
OPERATIONS MANAGEMENT
Prof. Dr. Cornelia Schön

Topic BA01: Personnel Scheduling – Review and Application

In the recent few years, personnel scheduling problems have been studied in different contexts. As labor cost is one major component in many industries, reducing this cost can be seen as very beneficial. Personnel scheduling problems face the challenge to assign employees to different jobs while satisfying certain constraints, like required skills, or collective agreement rules. A common objective is to minimize the total number of employees needed, travel costs, overtime costs or outsourcing costs, which all effect the bottom line of a production facility.

Mostly, a personnel scheduling problem is expressed as a (mixed) integer problem (MIP), which is often difficult to solve. Different approaches can be applied to counter this challenge. For example, Al-Yakoob and Sherali (2007) used a two-step model in a gas station context. In the first stage, employees are assigned to the stations, while in the second stage, shifts and off-days for each employee are specified.

The basic models from the personnel scheduling literature can be applied to a timetable management problem for students. In the class scheduling case, Kelly is a senior finance major at the Smith University who must take five more courses till her graduation audit. After gathering data about the course topics, meeting time and average rating, she wants to choose the optimal schedule for herself using knowledge learned from the personnel scheduling literature stream.

The objectives of this bachelor thesis are:
- to give an overview over the personnel scheduling literature,
- to describe a basic mathematical optimization model,
- to explain the challenges of MIP in the context of personnel scheduling problems and applied solution methods,
- to solve "Kelley's Class Scheduling" case by applying the presented basic mathematical optimization model and solving it with the Excel Solver (Part 2 of the case),
- to suggest extensions to the basic model that are currently discussed in the literature and are applicable to this case.

Basic Literature:

Van den Bergh. et al. (2013). Personnel scheduling: A literature review. *European Journal of Operational Research. Volume 226, Issue 3, 369-385*. https://doi.org/10.1016/j.ejor.2012.11.029

Al-Yakoob, S.M., Sherali, H.D (2007). Mixed-integer programming models for an employee scheduling problem with multiple shifts and work locations. *Ann Oper Res 155, 119–142.* https://doi.org/10.1007/s10479-007-0210-4

Pinedo, Michael L (2012). *Scheduling.* Vol. 29. New York: Springer.

Janice K. Winch, Jack Yurkiewicz (2014). Case—Kelly's Class Scheduling. *INFORMS Transactions on Education. 15(1), pp. 148–149*. https://doi.org/10.1287/ited.2014.0128cs

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Topic BA02: Der Einfluss der Digitalisierung auf Kundenkontaktmodelle

Dienstleistungen definieren sich neben Eigenschaften wie Vergänglichkeit oder Nichtgreifbarkeit vor allem durch den Kunden als Ko-Produzenten. Entsprechend spielt der Kunde eine zentrale Rolle im Rahmen der Dienstleistungserbringung, so dass den Kontaktpunkten zwischen Unternehmen und Kunden eine besondere Bedeutung im Hinblick auf Ausgestaltung und Optimierung zugemessen wird. Genau diese Schnittstelle hat sich über die letzten Jahrzehnte stetig verändert und soll in dieser Bachelorarbeit aus zwei Perspektiven betrachtet werden:

1) Aus theoretischer Sicht, indem die Frage beantwortet wird, wie der Kundenkontakt konzeptionalisiert und modelliert werden kann. Tools wie Service Blueprinting oder PCN-Analyse sind dabei nur zwei Beispiele.

2) Aus praktischer Sicht, indem reale Entwicklungen und veränderte Rahmenbedingungen des Kundenkontaktes näher beleuchtet und ihr Einfluss auf theoretische Modellierungsansätze diskutiert werden. Gerade die Digitalisierung hat hier in den letzten Jahren zu grundlegend neuen Formen des Kontaktes geführt.

Die Ziele dieser Arbeit sind:
- Eine Literaturrecherche zur Einführung und Definition der Begriffe Dienstleistung, Service Design und Kundenkontakt;
- Eine Darstellung unterschiedlicher Tools zur Konzeptionalisierung und Modellierung des Kundenkontaktes als der Schnittstelle zwischen Kunden und Unternehmen;
- Eine Betrachtung der Entwicklung des sich verändernden Kundenkontaktes in Theorie und Praxis über die letzten Jahrzehnte – mit einem Schwerpunkt auf die jüngsten Auswirkungen der Digitalisierung;
- Eine Erarbeitung offener Forschungsfragen und möglicher zukünftiger Forschungsansätze im Bereich Kundenkontakt.

Basisliteratur:

Bitner, M. J., Ostrom, A. L., & Morgan, F. N. (2008). Service blueprinting: a practical technique for service innovation. *California management review*, 50(3), 66-94.

Chase, R. B. (1981). The customer contact approach to services: theoretical bases and practical extensions. *Operations research*, 29(4), 698-706.

Sampson, S. E. (2012). Visualizing service operations. *Journal of Service Research*, 15(2), 182-198.

Sampson, S. E., & Chase, R. B. (2020). Customer contact in a digital world. *Journal of service management*, 31 (6), 1061-1069.

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Topic BA03: A Staffing Optimization Model to Balance the Risk-Efficiency Trade-Off

When designing a service offering, the underlying service operations must be aligned to deliver the promised or targeted service. Hereby, service providers face several operational decisions on how to design the service system. Different Operations Research approaches aim at supporting service providers in their decision making. Mathematical models can help to balance trade-offs, such as minimizing costs associated with the service delivery system while fulfilling basic service requirements. These requirements could, e.g., be certain staffing levels that must be met to secure the service provision.

Such an example is provided in the following paper: Kekre et al. (2009) develop a simulation optimization model for a commercial bank to address the risk and efficiency trade-off inherent to the check-clearing operations. Continued growth of electronic payments require banks to operate the check-clearing house efficiently, keeping personnel costs at a reasonable level while reducing the risk of delayed checks. The staffing model gives recommendation for a strategic downsizing program for the check-processing workforce.

The objectives of this thesis are to first review the use of simulation models in services in generally and in particular for staffing problems. Second, the case of Kekre et al. (2009) should be discussed in detail, reviewing both model and methodology used therein. Based on the prior research on simulation and staffing models, the student should critically assess the paper's contribution to theory and practice, including any gaps identified.

Basic Literature:

Kekre, S., Secomandi, N., Sönmez, E., & West, K. (2009). OM practice—balancing risk and efficiency at a major commercial bank. *Manufacturing & service operations management*, 11(1), 160-173.

Madadi, N., Roudsari, A. H., Wong, K. Y., & Galankashi, M. R. (2013, September). Modeling and simulation of a bank queuing system. In *2013 Fifth International Conference on Computational Intelligence, Modelling and Simulation* (pp. 209-215). IEEE.

Siferd, S. P., & Benton, W. C. (1992). Workforce staffing and scheduling: Hospital nursing specific models. *European Journal of Operational Research*, 60(3), 233-246.