

# Queuing Theory in Practice: Employing and Applying Queuing Theory for Humanitarian Registration and Assistance Delivery Activities





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# 01

## Value Delivery

Significance

Contribution to the discipline

Research Problem



# Queues around us

## Queues can be found everywhere:

- Commerce (e.g. supermarkets)
- Computers (e.g. CPU jobs)
- Networks (e.g. Data Packages)
- Healthcare (e.g. Hospital waiting lines)
- Transportation (e.g. Traffic lights)

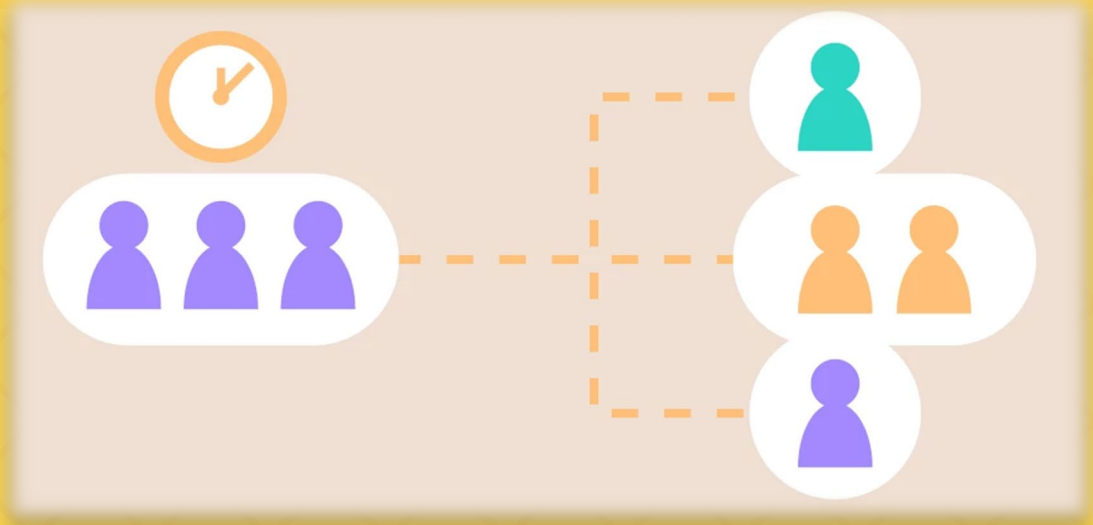


Image 1: Queues in a nutshell (Tšernov, N.D.)

# The matter at hand

## Queues in the humanitarian field:

- Registration activities
- Refugee Status Determination
- Resettlement, Relocation and Repatriation processes
- Family reunification
- Non-food item delivery
- Cash and Voucher delivery
- Protection activities
- Complain mechanisms



Image 2: Lines of people sleep rough on Petrou Ralli Street in Athens, hoping to get an interview date and a pink card in the morning.

(UNHCR/ K.Kehayioy, 2012)

# 02 Research Question: The Thought Process

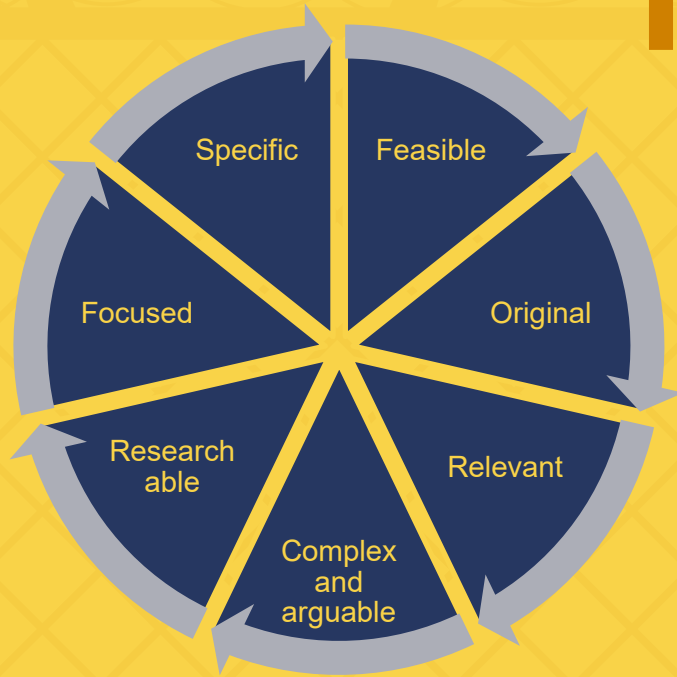


Chart 1: Characteristics of a strong research question (Scribbr, 2023)



# The Research Question

How can the application of queuing theory via computing systems enhance and optimise registration and assistance delivery activities in the humanitarian field



# 03 Aims and objectives



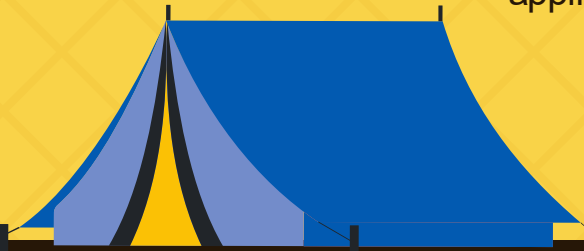
## Aim

Understand and present how queuing works and applies in registration activities



## Objectives

Provide a literature review, actionable recommendations and usable technological application



# 04 Literature

<b>Queuing theory and queuing theorems</b>	Probability, Statistics and Queuing Theory with Computer Science Applications" (Allen, 1990)	Stochastic Processes Occurring in the Theory of Queues and their Analysis by the Method of the Imbedded Markov Chain (Kendall, 1953)	Business Process Modelling, Simulation and Design (Laguna & Marklund, 2013)	
<b>Queuing theory in real life</b>	The queuing theory application in bank service optimization (Xiao & Zhang., 2010)	A Survey of Queuing Theory Applications in Healthcare (Fomundam & Herrmann, 2007)	Queuing Theory Accurately Models the Need for Critical Care Resources (McManus et al., 2004)	Queuing Theory and Modeling Emergency Department Resource Utilization (Joseph, 2020)

# Literature (cont.)

<b>Registration and assistance delivery activities</b>	Refugees and the emergence of the humanitarian field in Cameroon (Glasman, 2020)	Business intelligence and data analytics framework: case study of humanitarian organisations refugees' registration system (Ballout et al., 2022)	EASO Practical Guide on Registration Lodging of applications for international protection (EUAA, 2021)	Emergency registration in refugee operations (UNHCR, 2022)
<b>Queuing theory and psychological effects</b>	The Psychology of Queuing (Furnham et al., 2020)	Perspectives on Queues: Social Justice and the Psychology of Queueing (Larson, 1987)	How psychology might alleviate violence in queues: Perceived future wait and perceived load moderate violence against service providers (Efrat-Treister et al., 2019)	Looking Back: Exploring the Psychology of Queuing and the Effect of the Number of People Behind (Zhou, 2003)

# Literature (cont.)

<b>Queuing in humanitarian contexts</b>	Delivering Drinking Water by Truck in Humanitarian Contexts: Results from Mixed-Methods Evaluations in the Democratic Republic of the Congo and Bangladesh (Sikder et al.,2020)	THE GENDER HANDBOOK FOR HUMANITARIAN ACTION (IASC, 20 18)	Queuing to leave: A new approach to immigration (Sarma, 2021)	'The deserving': Moral reasoning and ideological dilemmas in public responses to humanitarian communications (Seu, 20 16)
<b>Applied queuing theory through technology</b>	Queueing Theory-Based Mathematical Models Applied to Enterprise Organization and Industrial Production Optimization (Rece et al., 2022)	Queuing and Elections: Long Lines, DREs and Paper Ballots (Edelstein & Edelstein, 20 10)	Queue Length Estimation Using Connected Vehicle Technology for Adaptive Signal Control (Tiaprasert et al., 20 15)	Real-time queue length estimation for congested signalized intersections (Liu et al., 2009)



# Literature (cont.)


**Queuing,  
computing and  
ethical  
considerations**

ACM Code of Ethics and  
Professional Conduct (ACM,  
2018)

The Public Impact of  
Queueing Theory: From  
Queen Elizabeth to Internet  
to Emergency Rooms  
(Saghafian, 2022)

Discussion: Queuing  
Theory Re-visited (Zelnick,  
2017)

Code of Conduct  
& Explanatory  
Notes (UNHCR,  
2010)



# 05 Methodology

## Qualitative

Literature Review  
Interviews (if possible)  
Available subject matter  
expertise

## Quantitative

Experiments (for the application /  
coding part)  
Publicly available datasets  
Privately available data (upon  
approval and authorization)

# 06 Ethical considerations & risk assessment





# 07 Artefacts

## Research Report

Research Report (main  
Artefact)

## Annexes

Such as the raw data  
used or source code

## Computing Artefact

Including but not  
limited to the usable  
application



# 08

# Timeline

	M1	M2	M3	M4	M5	M6	M7
<b>Preparation</b>	■						
Literature Review	■						
Resource identification		■					
<b>Data collection and analysis</b>			■				
<b>Development / Coding</b>					■		
<b>Review and Finalisation</b>							■
<b>Research Writing</b>	■						



# 09

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