University of Pretoria
Department of Industrial and Systems Engineering

Simulation modelling
Simulasiemodellering
BUY 321

Internal examiner:
Interne eksaminator:
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External examiner:
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Answer all questions on *clickUP*. Save early and frequently.

Beantwoord al die vrae op clickUP. *Stoor vroeg en gereeld.*

Complete all **3** questions for **14** marks
*Beantwoord al **3** vrae vir **14** punte*

Total time: 120 minutes
Totale tyd: 120 minute

Problem brief

You are tasked to build a simulation model that replicate the scenario given in the animation titled `S01-2021.mp4` available on *clickUP*, the *GitHub* repository and on *YouTube*. People arrive at the Covid-19 testing station in a way that can best be described using a Poisson distribution with a rate parameter of $\lambda = 31$ arrivals per hour. The testing station is quite small and the queue (applying 2m physical distancing) only allows for a maximum of five people at a time. If the queue is full, the person turns around and leaves. The testing staff are rotating but you can assume that there are four Covid-19 testers at any time for the entire period of 09:00–16:00. The testing time includes all the necessary paperwork and registration, and can best be described by a normal distribution with a mean time of seven (7) minutes and a standard deviation of ninety (90) seconds. Walking speed is 1.5m/s. According to current records, 15% of all tests come back as *positive*. But assume now that the test is only 78% accurate. So, 78% of thos who tested *positive* actually are *negative* and 78% of those who tested *negative* are actually *positive*.

Questions

1. Build a discrete event simulation model, in *AnyLogic*, using mainly the process modelling (discrete event) paradigm. This question in the assessment requires a file submission. Your entire model (folder) must be zipped (as a `⋆.zip` file, not a `⋆.7z` file) and submitted. Please rename the zipped file, using your student number as filename. For example, `01234567.zip`. The following aspects of the model will be assessed:

[2] (a) The model runs to completion for the specified period.

[2] (b) The animation is appropriately scaled.

[2] (c) The animation (and logic) depicts the persons in the testing station as well as those queueing.

[2] (d) The test results and test accuracy is captured using the model logic.

[2] (e) Overal neatness and presentation of the model, including useful block names.

[2] 2. What is the median value of the mean daily utilisation of the Covid-19 testers? Give your answer as a fraction. For example, if you believe the utilisation is 12.34%, give your answer as `0.123` (using three decimal places and a decimal point, not comma).

[2] 3. What is the median number of daily *false negatives*? A false negative is a person who tested *negative* but who is actually *positive*. Give your answer to one decimal place.

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