University of Pretoria
Department of Industrial and Systems Engineering

Simulation modelling
Simulasiemodellering

BUY 321

Internal examiner:
Interne eksaminator:
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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 **4** questions for **14** marks
*Beantwoord al **4** vrae vir **14** punte*

Total time: 120 minutes
Totale tyd: 120 minute

Problem brief

You are asked to build a simulation model for a small assembly station on a production line. Figure 1 represents a scaled layout of the portion of the line you will focus on, and a copy is provided electronically on *clickUP* as part of the assessment `S01-2020`. Flanges and bolts arrive from upstream workstations via their respective

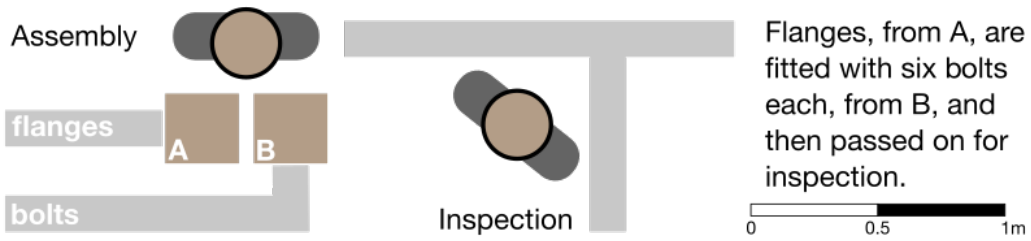

Figure 1: Process flow through the flange assembly and inspection station.

conveyors. During the January 2020 holiday period, before lockdown restrictions limited student visits to industrial facilities, a third-year student did a time study and recorded, over three hours, the number of flanges and bolts that arrived per minute at the assembly point. The data is available to you in `Arrivals.csv`. Bin A has space for 30 flanges while bin B can hold 200 bolts.

A worker assembles a flange and six bolts and then passes the assembly to an inspector on a conveyor. We can best describe the duration of the assembly process by a normal distribution with a mean of $\mu = 15$ seconds and a standard deviation of $\sigma = 1.8$ seconds. You can assume that the inspection activity is instantaneous as it occurs while the assembly is on the conveyor. Of all the inspected parts, 95% pass and proceed (towards the right) to downstream workstations for further processing. Faulty parts are counted, placed on another conveyor and set aside for later rework. All conveyors move at a speed of 0.3m/s.

Questions

0 1. This is strictly an individual assessment. You are welcome to access any documented material, but no communication with (any) other individuals via any mode or means. Carefully read the University's integrity statement and answer truthfully.

2. Build a discrete event simulation model, in *AnyLogic*, on the given scaled layout. The model should run for the duration of today's test, from 15:30–17:30. 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 scaled layout is used appropriately.

2 (c) The animation (and logic) depicts the flanges, bolts and assemblies being conveyed on the various conveyors.

2 (d) The arrival rates are realistically inferred and depicted in the simulation model.

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

2 3. On average, what is the utilisation of the assembly worker over the two-hour period?

2 4. On average, how many assemblies failed inspection and are left after the two-hour sessions?

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