Industrial Engineering & Management, 8-04-2020 15.00-18.00

Exam Production Planning & Quality Control

Name:

Student Number:

**Declaration of the Board of Examiners**

The Board of Examiners has allowed the conversion of your exam into a take-home exam. This conversion comes with the following additional provisions:

1. You are required to sign the pledge below, swearing that your work has been completed autonomously and using only the tools and aids that the examiner has allowed you to use.
2. Attempts at cheating, fraud or plagiarism will be seen as attempts to take advantage of the Corona crisis and will be dealt with very harshly by the board of examiners.
3. The board of examiners grants your examiner the right to conduct a random sampling. If you are selected for this sample, you may be required to conduct a discussion (digitally, using audio and video) in which you are asked to explain and/or rephrase (some of) the answers you submitted for the take-home exam.

I, (fill out your name) , have completed this exam myself and without help from others. I have come up with these answers myself. I understand that my fellow students and my lecturers are all doing their best to do their work as well as possible under the unusual circumstances of the Corona pandemic, and that any attempt by myself or my fellow students to use these circumstances to get away with cheating would be undermining those efforts and the necessary trust that this moment calls for.

**Please take note of the following:**

* You are required to write your answers in this document. When you have finished, upload this document on Nestor as Microsoft Word or Rich Text Format (rtf) document.
* The total number of words of this document (including questions and your answers) may not exceed **4000**. Note that this number is not an indication of quality. Good answers could also have much less words.
* Do not forget to fill in your name and student number on the first page.
* Make sure that you have added your name in the above declaration as confirmation of your pledge.
* This exam consists of 2 questions with sub-questions for a total of 100 points.
* You are allowed to consult the course articles, slides, and your notes during the exam.
* You are required to answer all questions in English.
* Give precise answers to the questions. Each answer must show that you have studied the articles and the slides. Avoid superficial, generic answers.
* Explicitly refer to the article(s) (including section and page number) and slides you base your reasoning on.
* It is not possible to ask questions during the exam to the teacher. If you think the exam contains errors, please mail the teacher after the exam with your remarks (w.m.c.van.wezel@rug.nl).

Good luck!!

**Question 1: Generic topics (56 points)**

a. Describe for each of the competitive priorities (lecture 1), how it can be affected by Additive Manufacturing. (10 points)

Answer:

b. Consider Table 5 in the article of Safizadeh et al. (1996). How do you expect this table will change due to the rise of Additive Manufacturing? (6 points)

Answer:

c. Describe, in terms of competitive priorities, what IoT could mean for a car manufacturer. You can address both the production process and the product. Illustrate your answer(s) with examples. (8 points)

Answer:

d. Extending on your answer in 1c, describe and explain, using the findings of Schroeder et al. (2002), how the car manufacturer could achieve competitive advantage using IoT. Be more specific than the mechanisms mentioned in the abstract of the article of Schroeder et al. (8 points)

Answer:

e. Explain the differences of performance metrics of planning and scheduling (van Wezel et al., 2015, p. 70-71) between a job shop and a flow shop. Include the typical competitive priorities of job shops and flow shops in your answer. (8 points)

Answer:

f. Black (2007) notes that “Many companies implemented Kanban (step 6) and made significant reductions in inventory levels (step 7) before the necessary system and cell design steps were implemented. Such implementations often result in failure.” (p. 3647). Explain, using the article of Sugimori et al. (1977), why this could result in failure. (8 points)

Answer:

g. Explain, using the article of Gino and Pisano (2008), which behavioral factors contribute to algorithm aversion. (8 points)

Answer:

**Question 2: Flow Production (44 points)**

a. Slide 16 of lecture 3 mentions: “Never forget: a group is not a collection of machines! It is a collection of machines plus products/parts”. Explain why this is the case. (8 points)

Answer:

b. On the slides of lecture 2 it is stated that “The challenge is to get flow in situations with low/medium volume, and with medium/high variety.” Explain (i) why this is challenging especially in these circumstances (4 points), and (ii) why it could be important to try anyway (4 points)

Answer (i):

Answer (ii):

c. Which of the factor(s) that make scheduling difficult (van Wezel et al., 2015) is/are reduced if the company switches from a process layout to a balanced production line? Why? (8 points)

Answer:

*For sub questions d and e, consider the following case:* You are asked to propose a balanced ‘production line’ for assessing an exam. The exam consists of two main questions, each having several sub questions. For grading the exam, each sub question can be regarded as a separate task that can be assigned to one of the assessors. The sequence in which the sub questions are graded is important; the sequence should follow the lettering (a, b, c, etc.). Sub question 1*a* should be assessed before 1*b*, and 1*b* before 1*c*, etc. Assigning sub questions of 1 and 2 to the same workstation is valid, and an assessor can assess sub questions of 1 and 2 interchangeably. Because questions 1c and 1d, and questions 2d and 2e are related, they needed to be assessed by the same person.

**IMPORTANT REMARK FOR 2d!** To individualize your assignment, calculate the cycle time in seconds, and then add the numerical value of the last two numbers of your student number to the cycle time. So, if your calculated cycle time is 250, and your student number is 123456, the cycle time you need to use in your line balancing procedure is 250 + 56 = 306. If you forget this, zero points will be awarded to 2d.

d. (i) Propose a balanced line using either the Rank Positional Weight procedure or the Longest Processing Time procedure. Show all steps that you make. Use the following expected average task times for assessing each sub question (in seconds): 1a: 120, 1b: 90, 1c: 150, 1d: 140, 1e: 160, 1f: 175, 1g: 180, 2a: 100, 2b: 160, 2c: 80, 2d: 200, 2e: 60. Assume that 150 exams need to be graded, and that all exams must be graded within 3 days of 8 hours (12 points). (ii) how many assessors are needed? (2 points). (iii) calculate the utilization of each assessors (2 points)

Answer (i):

Answer (ii):

Answer (iii):

e. Should your proposed line be a paced line or an unpaced line? Why? (4 points)

Answer:

---- End of the exam ----