

PRINCE OF SONGKLA UNIVERSITY

FACULTY OF ENGINEERING

Final Examination : Semester 1

Academic Year : 2009

Date : October 8, 2009

Time : 9.00-12.00

Subject : 225-554 Automation Manufacturing

Room : Robot

**Direction**

- There are 9 questions. The total score is 110.
- Write your own answer on the exam papers.
- All materials, books, calculators are allowed.

Assist. Prof. Wanida Rattanamanee

Name.....Code.....

Question	Full Score	Score
1	10	
2	10	
3	10	
4	20	
5	10	
6	10	
7	10	
8	10	
9	20	
<b>T.C.S</b>	<b>110</b>	



1. (10 points) Each aisle of a six-aisle Automated Storage/Retrieval System is to contain 50 storage compartments in the length direction and eight compartments in the vertical direction. All storage compartments will be the same size to accommodate standard size pallets of dimensions:  $x = 36$  in.,  $y = 48$  in. and  $z = 30$  in. Using the allowances  $a = 6$  in.,  $b = 8$  in., and,  $c = 10$  in., determine: (a) how many unit loads can be stored in the AS/RS and (b) the width, length, and height of the AS/RS. The rack structure will be built 18 in above floor level.

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2. (10 points) A 10-aisle automated storage/retrieval system is located in an integrated factory-warehouse facility. The storage racks in each aisle are 18 m. high and 95 m. long. The S/R machine for each aisle travels at a horizontal speed of 1.5 m./sec. and a vertical speed of 0.5 m. / sec. Pick and deposit time = 20 sec. Assume that the number of single command cycles per hour is one-half the number of dual command cycles per hour and that the system operates at 80% utilization. Determine the throughput rate (loads moved per hour) of the AS/RS.

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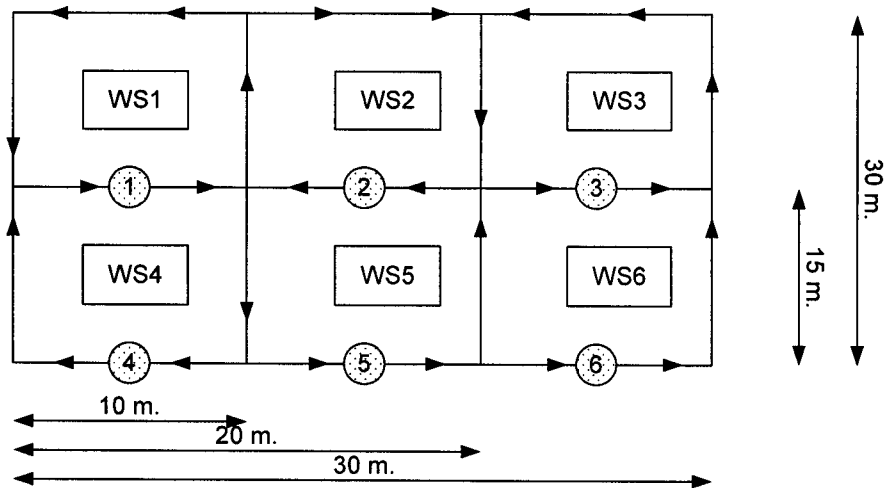
4. (20 points) In a factory, there are 6 workstations, WS 1, WS 2, WS 3, WS 4, WS 5, and WS 6. There are 5 products; A, B, C, D and E produced in the factory by these 6 workstations. From-to-chart for the factory is shown in Table1. The factory manager would like to apply AGV system for the production. He designed AGV guided path as shown in Figure 1. Material handling capacity of the selected AGV type is 10 kilograms per trip. Its velocity is 15 meter per minute. Its efficiency is 0.9 and it has to be charged the energy after it works for 8 hours (t = 45 minutes). Pick up and drop off time is 0.6 and 0.8 min. respectively. There are 10 work hours per day. Determine the following questions

4.1  $g_{12}$ ,  $g_{13}$ ,  $g_{23}$ ,  $g_{35}$ ,  $g_{36}$  and  $g_{45}$  (6 points)

4.2 How many AGV should be applied in the factory. (use the 2<sup>nd</sup> case, equation 7.3, from chapter 7 of the book.) (14 points)

Table 1 From-to Chart between department

From \ To	WS1	WS2	WS3	WS4	WS5	WS6
WS1	-	50	20	30	30	
WS2		-	45	20		20
WS3			-		10	
WS4	40		20	-		60
WS 5		50			-	40
WS6			20	20		-



⊙ = Pick up and drop off point

Figure 1 Guided path layout

- 4.1  $g_{12} =$
- $g_{13} =$
- $g_{23} =$
- $g_{35} =$
- $g_{36} =$
- $g_{45} =$

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4.2

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5. (10 points) What is "Manufacturing System"? How is it impact to the factory efficiency?  
Explain and give some example.

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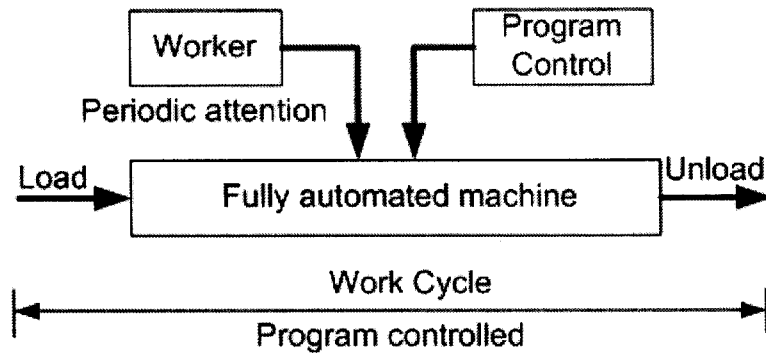
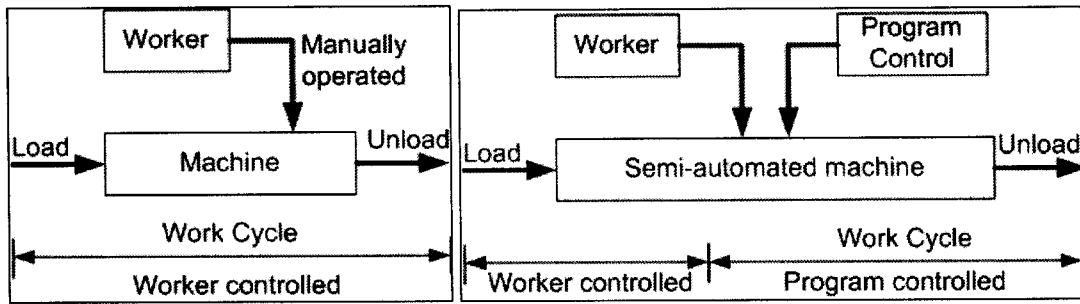
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6. (10 points) Explain the 3 following Figures.



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7. (10 points) Explain and give example about push and pull system.

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8. (10 points) Explain and give example about CAD-CAM, CIM and FMS.

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9. (20 points, 2 points per question) From the class presentations, answer these following questions?

9.1 From the paper "Verification and validation of a SSM model dedicated to mode handling of FMSs", what is the problem of the study?

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9.2 From the paper, "Simulation of automated guided vehicle (AGV) systems based on just-in-time philosophy in a job-shop environment", what is the most contribution of this study?

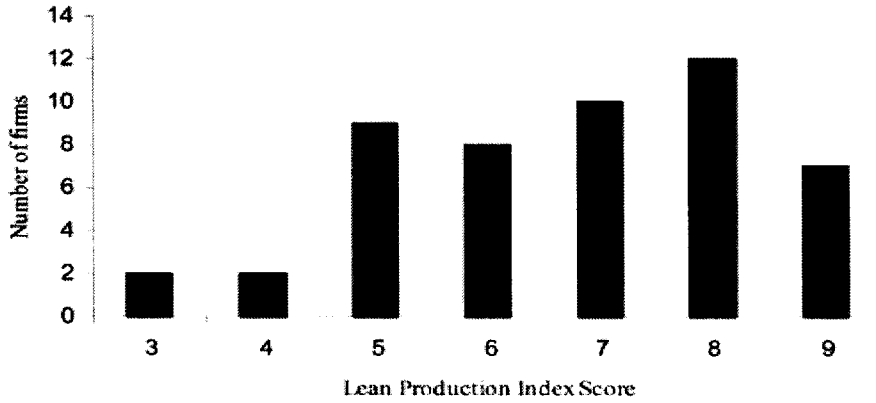
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9.3 From the paper “The use of a lean production index in explaining the transition to global competitiveness: the auto components sector in South Africa”, explain the following Figure.



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9.4 From the paper “Lean philosophy: implementation in a forging company”, what are the results from lean implementation?

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9.5 From the paper “Comparison of routing strategies for AGV systems using simulation”, explain Loop, Mesh and Cross-over Distance.

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9.6 From the paper "High-performance order picking concept around the logistacker AS/RS", what is the most important improvement in the final version?

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9.7 From the paper "AGV parking system using artificial visual landmark", what are the characteristics of landmark which guarantee accuracy and efficiency of detection the landmark?

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9.8 From the paper "Complexities of AGV modeling in newspaper roll delivery system", what is the objective of the paper?

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9.9 What is the "Design of a simulated environment for flexible manufacturing systems"?

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9.10 What is the "Design and simulation of a conceptual automated yard using new combination system"?

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