UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE AND ENGINEERING

FINAL EXAMINATION, APRIL 25, 2001

Fourth Year – Program: Mechanical & Industrial Engineering

MIE 445S – CASE STUDIES IN HUMAN FACTORS

Exam Type: A

Examiners: A. Smiley

Answer 5 out of the following 8 questions.

Each question is worth 8 marks for a total of 40 marks.

1. The case study described by Dr. Paul White concerned a review of a Ministry of Labour assessment in a manufacturing plant involving repetitive handling of scrolled metal sheets and soldering. The following chart using HumanScale data had been used to set limits to protect female workers from repetitive strain injuries. Have these data been used appropriately? Describe the limitations of using these data to set physical limits in this situation.

Female Size	1-handed lift kg (lb)		1-handed pull kg (lb)	
Small: stature 149.1 cm	3.6	(7.92 lb.)	4.9	(10.8 lb.)
Average: stature 161.5 cm	5.4	(11.8 lb.)	7.6	(16.8 lb.)
Large: 174.8 cm	18.0	(39.7 lb.)	13.6	(28.9 lb.)

2. The case study described by Dr. Bob Webb involved assessment of physical workload for firefighting teams. What issues had to be considered and what process was followed to determine the acceptability of 3, 4 or 5-man teams.

3. A shift work schedule was drawn up by a worker at a chemical processing plant. This schedule involved 8-hour shifts, rotating from evening to afternoon to morning. The morning shift start time was 6:00 a.m. One day off occurs after 6 nights, 3 days off after 6 days of afternoons and 3 days off after 6 morning shifts. All workers, including operators and maintainers, would have to adhere to this schedule. Operators spend much of their time sitting in front of a panel monitoring the plant process. Maintainers spend most of their time in active work. Discuss the effects of this schedule on efficiency, health and well being for both operators and maintainers. What recommendations would you make to improve this schedule?

4. At 11:00 p.m. an elderly driver was driving northbound in the passing lane of a highway with 2 lanes in each direction. The speed limit was 80 km/h. He saw headlights of a truck facing him in the opposing passing lane. Too late the elderly driver realized that there was a flatbed trailer (only 0.5 m in height) across both northbound lanes. He collided with the trailer and was killed. He left a very short skid mark – only 1 m. The truck driver had his low beam headlights on. He did not have his hazard lights flashing. He was backing into a narrow unlit private driveway on the east side of the road at the time the accident occurred (see figure). Discuss the human factors that contributed to this accident.
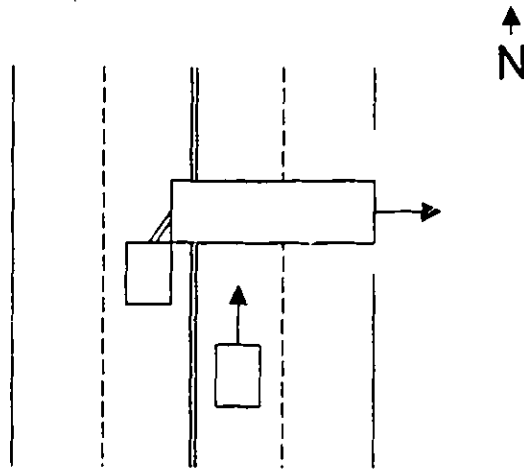
Figure – Position of vehicles in Q.4

5. A nurse inadvertently gives a patient 1,000,000 units of a drug, which is 10 times the correct dose. As a result the patient died. What human factors issues should be investigated to determine why the error occurred? What safeguards might be used to prevent such an accident?

6. You are developing a software program for accountants and want to use icons so that users can click on various functions (e.g. print, copy, past). Describe how you would go about testing whether users will understand the icons. Describe how you would go about improving the design of icons that are poorly understood.

7. You are asked to design a sign with the name of a hockey arena to be placed near the entrance, and to be used by drivers on Finch Ave. coming to the arena. What aspects will you consider in order to design an effective sign?

8. In our outdoor experiment, we were attempting to determine the accuracy with which it is possible to accurately determine from a distance whether two objects, which are laterally separated (a person and a pole), are aligned. Having carried out this experiment once, describe how you would carry out an improved version of the experiment.