June 10 2002 1:30-3:30pm DC 1351

Aids allowed:
Wickens
Set Phasers on Stun
Calculator

> **Please note: Solutions must be written in pen. No solutions written in pencil will be accepted for regrading. All solutions must be written on the paper provided.**

There are 11 pages, 10 questions, total marks = 50.

1.

A. (4 marks) Identify and describe the Gulf of Evaluation that occurred in Set Phasers on Stun.

1 mark: World – patient shocked
1 mark: no signal to perceive
1 mark: no signal to interpret   these 3 things comprise the Gulf of Evaluation
1 mark: could not evaluate

(+1 for reasonable definition of Gulf of Evaluation)

B. (3 marks) What information should have been available to Mary Beth?

from web:
1 mark: state of the machine
1 mark: output of the machine
1 mark: state of the patient

Answer *only one* of the following two questions.

2. (8 marks) Use the Human Action Cycle to explain what happened in the case study "Rental Car".

2. (8 marks) Alternate. Perform a Hierarchical Task Analysis of the Task described in "Rental Car".

HAC – From web:
Goal: Survive attack (both him and plane)
Intention: Fly the Thunderbolt
Sequence of Actions: Run, Find Plane, Operate its controls
Actions: could not operate the controls to fly but drove the aircraft instead
World: drove around, did not get hit
Perceive: light and sounds moving relative to bombs dropping (use senses)
Interpret: bombs did not hit airplane
Evaluation: attach survived / goal achieved
(3 marks if cycle is correct but does not match above cycle)

HTA
- should show 3 levels
1 Save plane from attack
    1.1 Get to plane
    1.2 Fly plane
    1.3 Avoid Bombs
        1.1.1 Run out of hangar
        1.1.2 Run down strip
        1.1.3 Find plane
        1.2.1 Climb in plane
        1.2.2 Operate controls
        (sequencing here)

3.

A. (3 marks) Bob is playing poker with his friends. He has a decision to make on his next move. If he keeps his current cards, his probability of winning is 0.1 and the winnings would be $27. If he takes a new card he could do better or he could do worse. However, the winnings in the second round are higher, $45. If he gets a worse card, his chances of winning will be 0.05, if he gets a better card, his chances of winning will be 0.2. What is the Expected Value of the different situations?

Students should have shown how to calculate expected value

$E(v)=p*v$ and then performed the calculation for all three situations.
They would have got:

      E(keeping cards)=0.1*$27=$2.70
      E(worse card) = 0.05*$45=$2.25
      E(better card) = 0.2*$45=$9

The astute student would have realized that at this point you can't make a decision. You still don't know the probability of getting a better or worse card. That comes in part b.

B. (3 marks) If the chances of getting a worse card are 0.75 and the chances of getting a better card are 0.25, what is the best decision that Bob can make?

In this part you are given those probabilities. Using the values from the first part, you now use these values to get the overall expected value.
    E(worse card) = 0.75*$2.25 = 1.69
    E(better card) = 0.25*$9 =$2.25

The best decision overall is for Bob to keep his cards since this has a total expected value of $2.70.

Marking comments:
Most people did this question correctly. Part A, 1 mark for calculating each value and showing work clearly. Part B, 1 mark for each of the calculations and 1 mark for the correct statement at the end.

Common errors:
Some people summed the probabilities in part b. This is incorrect - the additional risk in taking a different card makes the situation riskier. Multiple probabilities are handled by multiplying them together. However, thinking the question through should have revealed this relationship. No marks were given for this approach.

C. 4. (7 marks) Create a fault tree of the situation in "Wizards of Wall Street", showing how the accident evolved.

1 mark was given for getting the top of the tree correct. "crash on wall street" or "dow jones drops x points" were the correct answers.

1 mark was in general given for tree structure. This meant having ands/ors, 2 elements at each level (not 1).

The rest of the marks were given for a correct event-based chronological description. I was looking for two things - pairs of events that were concurrent within a level, and then a progression of chronology between levels. 2 marks for each level.

The following would have been an acceptable solution:
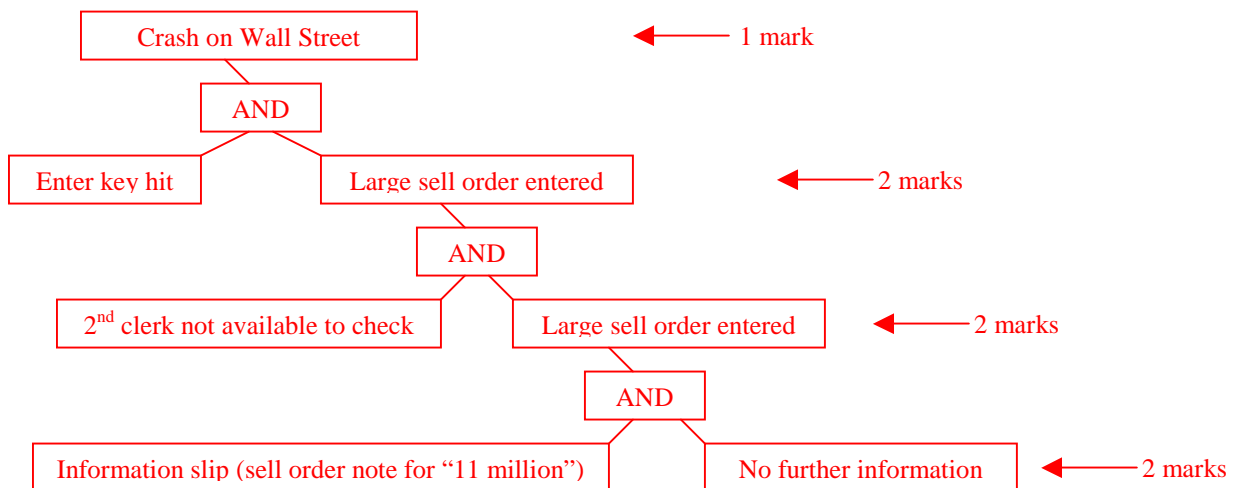
Common problems that would have earned deductions:
1. events at the same level not simultaneous
2. mixed up chronology across levels
3. description of things that are not events
4. structures that were not trees - single connections only

5. (6 marks) In "In Search of the Lost Cord", Karen connects an EKG cord to an IV
   pump. Her decision to do this can be discussed in terms of decision-making biases.
   Which two of the four categories of decision making biases can explain Karen's
   actions? Explain why Karen shows these biases, using evidence from the case study.

The most relevant biases are:
1. Input/cue – person accepts limited input
    - Karen only searched for 1 cord and did not keep searching
    - assumed matched features meant it was okay
2. Hypothesis Generation
    - Karen's only hypothesis was that if the features match/fit, cord is okay

The story says (p. 179) Karen considered only 1 hypothesis. Therefore hypothesis
selection and action had no real alternatives.

2 marks for picking the right 2 (eliminating the other 2 works well)
2 marks for description of each (definition and application to case)
* should be different categories
* 3/6 if same category
(1 category wrong but well explained: 1 mark)

The two categories were cue biases and hypothesis generation biases. No other biases
were allowed. 3 marks for the correct description of each. Each description should have
a definition and description of how the case fit the bias.

Karen generates only 1 hypothesis so hypothesis selection bias is not acceptable - there
were no other hypotheses to select from. So from the hypothesis generation phase there
is not a strong argument for any of the other biases.

Common errors:
1. Identifying biases but not categories. The question did ask for categories.
2. Hypothesis Selection or Action biases. These were not accepted.
3. Correct categories with poor explanation. Part marks only.

6. (3 marks) In "An Act of God" (p. 195), "Bill then proceeded to press the area trip buttons for the various stations, but nothing happened". What kind of error did Bill make and why?

Bill makes a mode error. He takes the correct action but the system is in the wrong mode so his action does not occur correctly. The switch was set to Frequency control and not to Trip/Reset, this constituted the wrong mode.
1 mark for mode error.
1 mark for explaining why.
1 mark for clearly indicating what the two modes were and explaining in the context of the story.

Common errors
1. Calling it a slip. This is not specific enough but if you explained it well you may have got a mark.
2. Calling it a mistake. No. Bill intended to trip the system. The story is quite clear about this.

7. (2 marks) A worker cleaning an auxiliary building at a power plant catches his shirt on a breaker. In pulling it free, he activates the breaker, shutting off current to the control rods in the reactor. The reactor shuts down automatically and it takes 4 days to bring it up again. Explain why this is an accident caused by system characteristics.

From web:
- unexpected interaction (nonlinear)
- tight coupling

8. (4 marks) Explain how the computerized system in Wizards of Wall Street can be considered to be "dumb and dutiful".

Dumb – because it didn't recognize the error
Dutiful – because it executed anyway

9. (3 marks) Identify three ways that the computer system in "Wizards of Wall Street" could have been improved to eliminate the error that Michael made. Be sure to explain the concepts behind the error reduction approaches.

1. Lockout – make very large sales impossible
2. Reversable – make it possible to undo errors
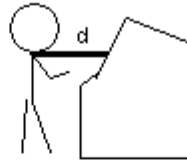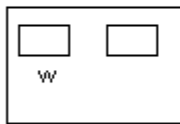3. Interlock – make double-checking mandatory on large sales

(4 marks) You are purchasing a new kiosk and are considering two different designs. In the first design, the buttons are large but placed far away. In the second design, the buttons are closer to the user, but smaller. Here are the dimensions of the designs:
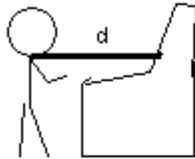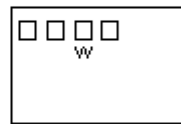

Design 1 d=1m

Design 2 d=0.5m

w=5cm

w=1cm

Design 1: distance = 1m
button width = 5cm

Design 2: distance = 0.5m
button width = 1 cm

Which design will people be able to use faster, and why?

1 mark: Fitt's Law: $MT = a + b \log_2\left(\dfrac{2A}{W}\right)$

1 mark: design 1: A = 1, W = 0.05, 2A/W = 40

1 mark: design2 : A = 0.5, W = 0.01, 2A/W = 100

1 mark: Design 1 will be faster (i.e. have smaller movement time) by Fitt's Law.

Name:_____

Student #: _____