King Saud University Model Solution
College of Computer and Information Sciences
Information Systems Department

Course Code/Title: IS 466 (Decision Support System)
TOTAL MARKS: 40
Exam: **FINAL** **Semester / Year**: Fall 2016-17
Exam date: January 12, 2017
Time Allowed: 2 Hours

Student ID: _____ **Name**: _____

EXAM POLICY&ETHICS:

- Read the paper carefully, should have any query be asked within first 15 minutes.
- Closed-book exam, no course-related papers are allowed.
- During examination, any form of communications with peer students is strictly forbidden.
- Students will not be allowed to attend the exam if arrived 20 minutes after the exam starts.
- Mobile phones should strictly be off.

QUESTIONS/ STUDENT OUTCOMES: This exam covers the following student outcomes (SOs):

Outcomes Covered	Questions	TOTAL
	Question 1	**/10**
	Question 2	**/10**
	Question 3	**/10**
	Question 4	**/10**
	Total	**/40**

Q1 (a) What is simulation? Describe the types of simulations ? (3 mark)

A Simulation develops method to numerically evaluate a system over some period of time. It attempts to duplicate the system.

Types of simulations are:-

1) Continous simulation that monitor system each time a change in its state take plea.
2) Discrete system that monitor change in state at discrete point in time.

Q1 (b) When do we prefer to develop simulation model over an analytical model? (1 mark)

1. When not all underlying assumptions sets for analytical models are valid.
2. when analytical model repuire more mathmatics which is complex
3. When "good" solution (not necessarily optimal) are satisfactory.

Q1(c) List some advantages and disadvantages of simulation model over analytical model? (2 marks)

Advantages	Disadvantages
1. Flexiable, straigh forward	1. Can be expensive and time consuming
2. Can include real time complication	2. Does not yeild optimal solution
3 Doesnot repuire to interface with real world system	3. Result are not generalizable to all possible solution.

Q1 (d) Set up the demand distribution table (random number interval values) given the following demands and probabilities. (2 mark)

Demand	Probability	Cumulative Probability	Random number interval
100	0.10	0.10	01-10
150	0.40	0.50	11-50
200	0.30	0.80	51-80
225	0.20	1.00	81-00

Q1 (e) Calculate the expected monthly demand given following monthly demand probability? (2 mark)

Demand	Probability
10	0.10
15	0.20
20	0.40
25	0.30

Expected monthly demand = $\sum$((i demand value) × (Probability of i demand value))
= (10 × 0.10) + (15 × 0.20) +(20 × 0.40) +(25 × 0.30) = 17.5

Q2 (a) Suppose we have six symbols A B C D E F with probabilities:

$P_A = 1/4$ $P_B = 1/8$ $P_C = 1/8$ $P_D = 1/8$ $P_E = 1/8$ $P_F = 1/4$

(a)What are (i) entropy (H) and (ii) information quantity (I) ? (2+2=4 marks)

$H(A) = \log_2(P_A) = 2$ bits
$H(B) = \log_2(P_B) = 3$ bits
$H(C) = \log_2(P_C) = 3$ bits
$H(D) = \log_2(P_D) = 3$ bits
$H(E) = \log_2(P_E) = 3$ bits
$H(F) = \log_2(P_F) = 2$ bits

$I = 1/4(2) + 1/8(3) + 1/8(3) + 1/8(3) + 1/8(3) + 1/4(2) = 2.5$

(iii) If code (A) = 01, code (B) = 001, code (C) = 101, code (D) = 001, code (E) = 111, code (F) = 11
So string of 6 symbols AFDCBE is 01 11 001 101 001 111 (16 bits)
For 6 symbols we need 16 bits, the average is 16/6 = 2.66 bits per symbol

Q2 (b) S is the sample of training data, s element from S

p element of class P: buys_computer = "yes"
n element of class N: buys_computer = "no"
The information quantity { I(p,n)} needed to decide whether s belongs to P or N
Furnish the table, find E(age) = 0.694 and Gain (age) = 0.246? (4 marks)

age	pi	ni	I(pi,ni)
<=30	2	3	0.971
31 - 40	4	0	0
>40	3	2	0.971

$E(age) = \frac{5}{14} I(2,3) + \frac{4}{14} I(4,0) + \frac{5}{14} I(3,2)$

$= \frac{5}{14}(0.971) + \frac{4}{14}(0) + \frac{5}{14}(0.971) = 0.694$

$Gain = I(p,n) - E(age) = 0.940 - 0.6940 = 0.246$

$I(2,3) = -\frac{2}{5}\{\log(2/5) / \log_{10}(2)\} - \frac{3}{5}\{\log_{10}(3/5) / \log_{10}(2)\}$

$= 0.528 + 0.442 = 0.971$

$I(4,0) = -\frac{4}{4}\{\log 4/4\} - \frac{0}{4}\{\log(\frac{0}{4})\} = 0$

Q2(c) What are the strength and weakness of decision induction tree? (2 marks)

Strength in Induction tree	Weakness in Induction tree
1 Easy to generate simple algorithm 2. High & easy to control 3 Fast & easy read small tree 4 Highly expressive	1. Not always sufficient to learn complex concept. 2. Hard to understand, if tree are large 3 Some problem cannot be discretized 4 Method to handle missing values are clumsy.

Q3(a) Describe the components of the expert system? (2 marks)

1. User Interface - how expert system interact with user.
2. Knowledge Acquisition system - process used to define rule
3. Interface Engine - choose rule to fire
4. Working Memory - contain data receive from user during expert system scenario.

Q3(b) What are the benefit and limitations of expert system? (2 marks)

Benefits of Expert system	Limitations of Expert system
1. For decider, consider more alternatives and consistant logic 2. For Firm - better performance from management team - Retain firm knowledge resources	1. Work only in narrow domain of knowledge. 2. May not arrive at valid conclusion. 3 Cannot handle inconsistant knowledge 4 Can't apply judgement or intuition.

Q3(c) What is the difference between expert system and knowledge base? (2 marks)

Expert System is a computer system that emulate decision making capability of human expert.

Knowledge base System is a computer program that reasons and use knowledge base to solve complex problem It may refer to different type of system.

Q3(d) Describe the main types of inference in expert system ~~with examples~~? (2 marks)

Two main types of inference in expert system are:-

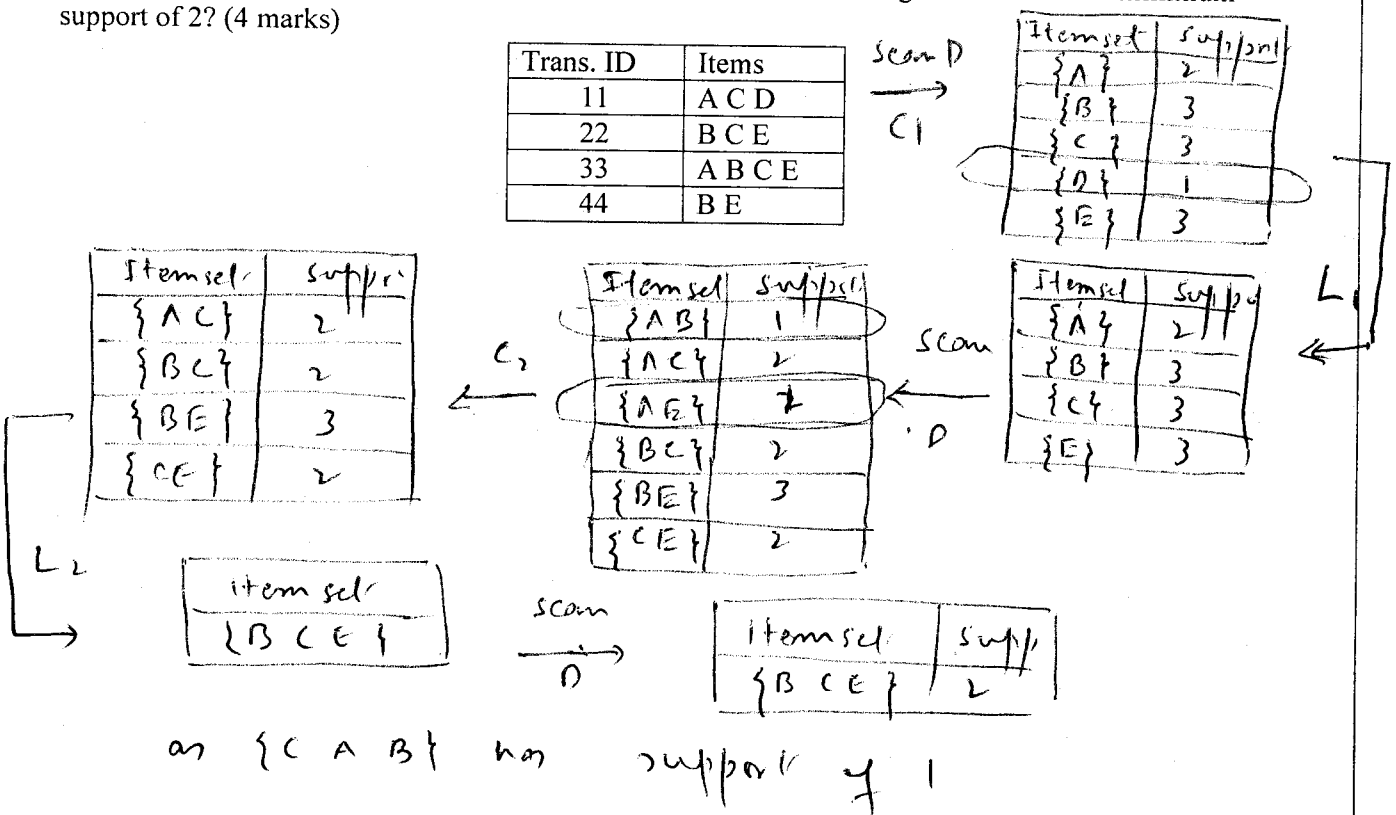
1. Forward chain — start with some facts in working memory, keep using the rule to draw new conclusion and take new action.
2. Backward chain — start with goal and look for rule that will help to achieve goal, chaining backward until you reach initial conditions.

Q3(e) List four popularly inference techniques used in real environment? (2 marks)

1. Inference with frame
2. Inference with propositional logic
3. Inference with first order logic
4. Inference with descriptive (ontology web language) logic

Q4(a) Using association extraction Apriori method, mine the following base table with minimum support of 2? (4 marks)

Trans. ID	Items
11	A C D
22	B C E
33	A B C E
44	B E



as {C A B} has support of 1

Q4(b) Consider the large frequent item set l = {B C E}, find the confidence (c) of all subset (s)? (4 marks) Non empty set are:- {B} {C} {E} {B C} {B E} {C E}

confidence

B and C => E — conf = 2/2 = 100 %
B and E => C — conf = 2/3 = 67 %
C and E => B — " = 2/2 = 100 %
B => C and E — conf = 2/3 = 67 %
C => B and E — " = 2/3 = 67 %
E => B and C — " = 2/3 = 67 %

Q4(a) Define the measures support and confidence is perspective for DSS? (2 marks)

Support (s) refer to probability that a transaction contain $X \cup Y$

i.e. $\text{support}(X \rightarrow Y) = P(X \cup Y)$

confidence (c) refer to conditional probability that a transaction having X also contain Y

$\text{confidence}(X \rightarrow Y) = P(Y/X)$

where X and Y are sets of distinct literals.