**EXAM 2** **AI Fall 2017**

[4 questions, 32 points Undergrad, 41 points Grad, 45 min

WRITE YOUR NAME and LAST 4 DIGITS OF ID:

*Symbols used below:* ~ is NOT, ^ is AND, || is OR

**Q1a.** Which of the following is/are *valid*? Explain in a line each if necessary. [12]

[*Hint: valid is always true*]

**i)** False => True *~F V T always T is valid*

**ii)** True => False *~~T V F invalid*

**iii)** False => A, for any proposition A *~F V A always T = valid*

**iv)** True => B, for any proposition B *~T V B not always T = invalid*

**v)** Forall x, P(x) || ~P(x), for a predicate P(x) with a variable x *One of them always T = valid*

**vi)** Forall x, Smart(x) || (x=x) *One of them always T = valid*

*Key:*

**i) – ii)** *Q7.4a, b*

**iv)-vi)** *Q8.6b, c*

**Q1b.** For propositions *A, B,* and *C* how many models exist for the sentence below? Use a truth table to answer the question. [4]

~ A || ~B || C

*Key:*

*7.7b*

*Truth table 2^3. Models are all lines where the expression is T, numbering 7.*

**Q1c.** Convert the following sentences over propositions A, B, C, D, and E, to *clausal* forms or *conjunctive normal forms*.

**Q1d.** Prove *A* by showing steps of resolution. [Hint: Add another clause corresponding to this query and apply resolution steps (“cancellation” process) as an upside down tree.] [3+3]

S1. A < => (B || E).

S2. E < => D.

S3. C ^ F => ~B.

*Key:*

*7.20*

S1: (￢A ∨ B ∨ E) ∧ (￢B ∨ A) ∧ (￢E ∨ A).

S2: (￢E ∨ D).

S3: (￢C ∨ ￢F ∨ ￢B).

*Adding ~A and running resolution should lead to F.*

*Only clauses from S1 are needed.*

**Grad Q1d.** Prove by drawing Venn diagram for each assertion A, B, and C below.

If A |= B or C |= B (or both) then (A ^ C) |= B [4]

*Key:*

*7.6a*

*Set A subset of set B. Set C subset of set B.*

*Set (A ^ C) is intersection of those of A and C.*

*Hence, that common area of A and C will be subset of set B.*

**Q2a.** Given, [10]

P(test|disease) = 0.99

P(~test|~disease) = 0.99

P(disease) = 0.0001

find, P(disease|test), P(~disease|test) and P(~test|disease).

*Key Q13.15*

Find P(disease|test)

= P(test|disease)P(disease) /

P(test|disease)P(disease)+P(test|￢disease)P(￢disease)

= 0.99×0.0001 /

0.99×0.0001+0.01×0.9999

= .009804

**Grad Q2b.** Given, [5]

P(V ) = 0.7

P(~A|V ) = 0.5

P(V|A) = 0.10

find the a priori probability of random event A.

*Key:*

*P(A)\*(1-P(~A|V)) = P(V)\*P(V|A)*

*P(A) \* 0.5 = 0.7 \* 0.1*

*P(A) = 0.07/0.5 = 0.14*