Program Studi Informatika
Sekolah Teknik Elektro dan Informatika
Institut Teknologi Bandung

Quiz 1
IF1220 Logika Komputasional
Waktu : 90 menit
Sifat Ujian : Tutup Buku, Tutup laptop, Tutup gadget

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Bagian 1 : Syntax, Semantic Reasoning

Notation: we use ~ for negation, & for conjunction, | for disjunction, => for implication, <= for reduction, and <=> for equivalence. Please use the same notation in your solutions.

1. Syntax

Determine whether each of the following is a sentence of propositional logic. Answer with YES or NO(no explanation necessary).

(a) classes & homework => time-consuming

(b) ((in & out) | (kreme & kreme)) <=> stomachache | ~stomachache

(c) false = F

(d) 2 & 2 => 4

(e) sleep(me, night) => zzzzz

(f) a & (b <= q | (p & ~c | t) <= s | v) <=> (~u | m) | d

(g) (love & potion => number9) <=> fullMoonRising

(h) one & two => notfour

(i) ~~~~true

2. Translation

Translate the following English sentences into sentences of propositional logic. Use only the logical constants we provided for you. For instance, the sentence "It is either raining or snowing" with the given logical constants:

raining = "It is raining" snowing = "It is snowing," *should be answered by:*

raining | snowing

(a) "When I study at Happy Donuts, I like to eat old-fashioned glazed donuts only if I can drink coffee as well."

s = I study

h = I am at Happy Donuts

d = I like to eat old-fashioned glazed donuts

c = I can drink coffee

(b) "Unless the stars twinkle, neither the dish nor the spoon will run away – except if the cow jumps over the moon, then only the spoon will not run away."

t = the stars twinkle

d = the dish runs away

s = the spoon runs away

c = the cow jumps over the moon

(c) "You can go to the fair if you are not sick, but otherwise you must stay home and rest."

f = you can go to the fair

s = you are sick

h = you stay at home

r = you rest

(d) "I did not do it, and if Walter did not do it, then Mike did it if and only if she promised to give him ice cream with hot fudge."

s = I did it

w = Walter did it

m = Mike did it

p = she promised to give him ice cream with hot fudge

3. Validity, Satisfiability, and Unsatisfiability

Determine whether each of the following sentences are valid, contingent or unsatisfiable. A one-word answer (VALID, CONTINGENT or UNSATISFIABLE) is all that is needed for each subproblem. Should you decide to solve this problem by creating truth tables, you may declare other constants to stand for substatements to make your tables easier to manipulate

(a) (p => (q => r)) <=> ((p & q) => r)

(b) (p & (q => r)) <=> ((~p | q) => (p & r))

(c) (p & ~q & ~r) <=> ((p & ~r) => (q | r))

(d) ((~r => ~p & ~q) | s) <=> (p | q => r | s)

Bagian 2 : Propositional Proof (Rule of Inference dan Standard Axio Schemata)

1. Gunakan aturan referensi:
   a). Diberikan premis {p, p ⇒q, (p ⇒q) ⇒ (q ⇒r)}, buktikan {r}
   b). Diberikan premis {p ⇒q, q ⇒r}, buktikan {p ⇒r} (Nilai 6-6)

2. Jika diberikan fakta {p ⇒q, q ⇒r}, buktikan dengan aksioma skema (II dan ID) dan inferensi (MP) bahwa dapat dicapai kalimat ((p ⇒ ¬r) ⇒ ¬p) ⇒ ((¬r ⇒ (¬q ∧ ¬p)) ⇒ ((p ⇒ ¬r) ⇒ ¬p)).
   (Nilai 8)

3. Hari ini hujan lebat dan badai angin, sehingga Badu tidak pergi kerja. Jika Badu tidak pergi kerja, tidak mendapat bonus. Hari ini badai angin tetapi Badu tetap mendapat bonus.
   a). Terjemahkan kedalam kalimat logika premis-premis diatas
   b). Gunakan aturan inferensi (silogisme, MT, dan simplifikasi) untuk membuktikan"hari ini tidak hujan"
   (Nilai 4-6)

Bagian 3 : Propositional Resolution (Closure form and Resolution)

1. Ubahlah tiga kalimat proposisi berikut ke dalam bentuk klausa, dengan menunjukkan hasil dari tiap tahapan secara lengkap, pada tabel di bawah soal. (Nilai 12)
   a. ¬(q ∧ p) ⇒ (r V s)
   b. ¬((p ∧ q ∧ r) V (p ∧ q))
   c. (r ∧ s) ⇔ ¬(p V q)

2. Dengan menggunakan propositional resolution tunjukkan bahwa klausa berikut: {¬ p, q, u, t}, {¬ t}, {¬q}, {¬r, t, ¬u}, {¬r, t, p}, {r} bersifat unsatisfiable. (Nilai 8)

3. Tentukan apakah kalimat proposisi berikut ini valid, dengan menggunakan *propositional resolution*. Jawaban harus menunjukkan hasil dari tiap langkah pemanfaatan *propositional resolution*. (Nilai 15)
((p ⇒ r) V (q ⇒ r)) ⇒ ((p ∧ q) ⇒ r)