YEO, Hudson (hcy20)

Imperial College London

Department of Computing Academic Year **2020-2021**



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70051 rac101 2 t5 hcy20 v1



 ${\bf Electronic_submission}$

Sat - 31 Oct 2020 12:27:24

hcy20

Exercise Information

Module: 70051 Introduction to Symbolic

Artificial Intelligence (MŠc AI)

Exercise: 2 (CW)

Title: Logic FAO: Craven, Robert (rac101)

Issued: Tue - 20 Oct 2020

Due: Tue - 03 Nov 2020

Assessment: Individual Submission: Electronic

Student Declaration - Version 1

• I acknowledge the following people for help through our original discussions:

Hudson Yeo (hcy20)

Signed: (electronic signature) Date: 2020-10-28 18:49:45

For Markers only: (circle appropriate grade)

YEO, Hudson (hcy20) | 01944572 | t5 | 2020-10-28 18:49:45 | A* A B C D E F

li	b: Michael is either fulfilled or rich
	g: Michael is rich
	q: Michael will live another 5 years.
	7p → 7q
	(T) = + (A receptor)
li	p: snowstorm arrives
	g. Raheem wears his boots
	r: I'm sure it will arrive a son of 15 (T)
	((p) vq) nor
	A = (A TI) v. Pra
انن 🌒	p. Akira on set, q: Toshino on set
	r: filming will begin
	S: caterers have cleared out
	$(p \land q) \rightarrow (r \leftrightarrow s)$
	(7 5- 911) (41 / 19) - 7 (11 / 19) - 7 (1 6 - 2)
iv	p: Irad arnved 11+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1+1
	a: Samh arrived
	(prq) 17 (prq)
. 2	Remaind the state of a first dear a series of the control of the c
	a saint on temperate and
٧	p: Herbert heard the performance
	q: Anner-Sophie did & hear the performance
	r: Anne-sophie answered her phone calls.
	$\neg r \longrightarrow \neg (\rho \land q)$
	1 Carlo A in carefullo it there is come is
<u> </u>	A propositional formula, A, is sortistique if there is some v
	such that hy(A) = t
	The propositional formulas are logically equivalent if for every v,
ü	hy (A) = hy (B)
	$h_{v}(A) = h_{v}(D)$

	NO.: Old CLD: 9/044215 000 Date: UNI
	Sign of Aniversity
7;;;	suppose - A sourstiable don don to ballitud a leading of it
-111	for some V, we have ho(7A) = +
	hence hy(77 A) = f #UKOKNASTOR
	but hv (T) = t
	so h, (¬¬A) ≠ h, (T)
	thus 77 A #T 23VIND METERONZIA
	suppose 77 A #T Llood on noon mandage, a
	hy(T) = t for some v svivo Him is some miles
	50 hy (77 A) #t 70 1 (91)
	and $hv(77A) = f$
	hence hy (TA) = t onin son no or serling in.
	and TA is satisfiable was the animality
	recept have dealed out (pap) -> (qe+>r)
	(7 (de) (qqq)
3	$ \begin{array}{ccc} P & q & r & (P \land \neg q \leftrightarrow \neg (\neg r \lor \neg P)) \longrightarrow (\neg \neg q \longrightarrow r) \end{array} $
	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
	t trattant it
	When $v(p)=t$, $v(q)=t$ and $v(r)=f$ the overall propositional
	When $v(p)=t$, $v(q)=t$ and $v(r)=f$, the overall propositional formula is evaluated as false
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4ia b c	when v(p)=t, v(q)=t and v(v)=f, the overally propositional frimula is evaluated as false In CNF, not in DNF In CNF, not in DNF Not in CNF Not in C
	When $v(p)=t$, $v(q)=t$ and $v(r)=f$, the overall propositional formula is evaluated as false In CNF, not in DNF In CNF, not in DNF Not in CNF, not in DNF Not in CNF, not in DNF
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4ii		PRIOR FE LIQ
	Let S be in CNF.	pring sur per 10
	Stres(PL) Ø iff S = I	PAGE IS NOW!
). OFY	45 6 65 6
	This property is important because it is	used in many SAT-savers.
	The property is also the rane as:	gr v h
	Let S be in CNF	- g 🗸 n
	Strescell iff S is satisfiable	19 And Sonot
	If it is impossible to derive \$ for	rom S by a resolution derivation
	then S is satisfiable.	
	PEX (80 1) Y (41 A)	
		FAD 6: 11 compt
tija	Apoly upth prop and pure rule:	a set the graft
	{{p,s},{q,r},{75,q},{77,75	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
	=> {{p,s}, {¬p,¬r,¬s}} (q pure)	Hallacet C
	=> {{p,s}} (ar pure)	N 1 1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4
		BURARITACHI
	Satisfiable	
	which to any a reserve is preserve	LIAN HE CHO E LINES
7,000		£ ,
1	Apply unit prop and pure rule:	
) 0	{{\p, q, r}, {\partial}, {\p, r, q}, {\pr, a}	Markage 10
		nit propagation of 79)
	=> {{-p}, {p}} (unit propagation of]	D) 5 1
		17.17.5
	unsatisfiable	1 X1V I
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The second secon		
		™ bazic⁻

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5	p: I am going	ii A
	a: you are asing . FIND of sid ? to	
	r: Tara is going 172 77.	
	p → 79 = 7p V79	
	he property is important because it IT VIPI = more the provery	D.
	he property a duo eque the care as: qrv	
	rvp 3MD ni sd 2 to	
	hence check if: slowithing is 2 77: 0, 11 2	
erVation,	ab MPTATION, TOTAL TOTAL TOTAL AND THE TOTAL	
1	using the logical equivalent, check if following is sortistiable	ļ-
	$(p \rightarrow \neg q) \wedge (\neg q \rightarrow \neg r) \wedge (r \vee p) \wedge (r \vee p) \wedge \neg q$	
	Applying DP to CNF form,	
	{ {7,79}, {9,71}, {r,79}, {r,p}, {19}	r/()
	=> { 17r}, {r,7p} {r,p}} (unit propagation of 79)	
	-> 12795, 2955 (unit propagation of ar)	
	-> {2}} (unit propagation of p)	
	UNSATISFIABLE (STATE)	
	slamitumi.	6
-	since the CNF is unsatisfiable, the original argument is proposi	tionally valid
	Shir shing ben going those digit	d
	1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	
	(Pr) 1 0 1 1 1000 1 12 11 1 1 1 1 1 1 1 1 1	
	northeadad Han). All f. 1977 =	
	S 18 78 so forms proporaution of P)	
	ollo it utpurp	
		M hazic

1	NO.: Date:
6;	L: C = {andrea}
01	P, = {cupcake}
	$P_2 = \{ \text{aunt} \}$
	$P_3 = \{ \text{ give } s \}$
	3 CJ 32 X 7
has	3 10%
8,412	46 0 211
-1/3°.	$\forall A \forall B \exists C \exists D ((aunt (A,B) \land aunt (B, andrea)) \rightarrow (gives (A,C,D))$
	Cupcake (c)
	$\wedge \neg (D = andrea))$
	My 184 00 191 19 19 19 19 19 19 19 19 19 19 19 19
11	1: P = { computer} where I some suit it was
	Po = { connected}
	$\forall X \exists Y ((computer(X) \land \neg connected(X,X)) \rightarrow (computer(Y) \land connected(Y,X)))$
	Anala Zi ar maning most (A) is must
iïi	1: C={Paul Klee, Kandinsky}
- 1	P. = { painting, British Galley, room }
	P2 = { painter, hangs in}
	Let My / A Se A Che A (X-d) A C C - L) LAN
	Wp = G ((painting (p) A painter (Paul Klee, p) A British Gallery (G)
	hanas in (D, G)
0	→ YK (painting (K) ~ painter (Kandinsky, K)
,	Louis in (C C)
934	$\rightarrow (\exists r (room(r) \land hangs in(p,r) \land hangs in(k,r))))$
iv	1: $P = \{loves\}$ $(X,X) \rightarrow \neg (AX \exists Y (loves(X,Y))) $
	t ((Y,X) saval) YEXA) ~ ((Y,X))saval) XE~XE)
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	STORE SAND SAND SAND STORES TO SAND SAND SAND SAND SAND SAND SAND SAND
	M bazic

	NO.:	Date:
	C - C	
	C={J,k,l} P,={b,w,s,c}	1044moles 0 116
	P, > { b, w, s, c}	15-187137-3
The State of the S	+=	PTINE E - ST
•		22 din g = 31
1	False.	
	ack, X) is satisfied when	there is an arrow from K to X, and
	this is only true when of X	= j. But then 7(X=j) is false.
	so it is False that YX (a	$a(k,x) \rightarrow \neg(x=j)$ since there is
(one assignment for X that make	us it false.
((a))	$i \alpha = 0 \cdot 0 \cdot \Lambda$	
<u>ii</u>	True	•
	((l) is true since I is	ircular is atugated &= e7 1 1
,	bally gristary Thur rather	1 (Fallange) = 8
ted(Y,X)	consider k in the domo	VX3 Y (((CME ate, (X) 15 TEARNIE Will
	b(K) true, since	
	c(k) true, since k	is circle sold bed bed in
	and a (1, K) true, s	me there is an arrow from I to k
	· · · · · · · · · · · · · · · · · · ·	K) is a true satisface ? = 1
	and $((1) \longrightarrow \exists x (b(x))$	AC(X) A a(l, X)) is true
(0)	walled detail a constant	
iii	False	110 alas sound A
	consider when $\sigma(X) = 1$, $\sigma(Y)$	()= K
		Y) the and (¬(x=Y) ∧ a(X,Y))
(halim		a(X,Y)) so the orginal statement is false
		,,,,,,,, .
iv	False	\$ 1200 \$ 5 S. W.
		-square objects, or jik, L.
		en a(X,Y) true only if o(Y)=1
	but I is not black	16 p() 11 tage
	(Y) d n (Y)) YE nout	Nach Y) is table
	and here overall	statement is false since consequent false
		M bazic -