EXAM MATHS-1 (**LOGIC**)

October 2017

DEGREE IN COMPURER SCIENCE-UA

STUDENT					
Questions (2 p)	Ex1 (1.50 p)	Ex2 (2.5 p)	Ex3 (1.50 p)	Ex4 (2.5 p)	TOTAL

FInal quaiification is given by adding the partial ones.

Exercise 1 (1.50p). Study the validity of the reasoning R1 through a truth table and explain the result.
R1: *"I am happy only if I sing. It is enough that I sing to smile. Therefore, I am not happy unless I smile."*

MC = { **ha:** I'm happy ; **sg:** I sing; **sm:** I smile}

Formalización

P1:____ha ⇒sq____

P2:____sg ⇒sm____

Q:_____ha⇒sm____

NOTE: use as many columns as needed

	ha	sg	sm	P1: ha ⇒sg	P2: sg ⇒sm	⇒	Q: ha⇒sm	
1	0	0	0	1	1	1	1	
2	0	0	1	1	1	1	1	
3	0	1	0	1	0	1	1	
4	0	1	1	1	1	1	1	
5	1	0	0	0	1	1	0	
6	1	0	1	0	1	1	1	
7	1	1	0	1	0	1	0	
8	1	1	1	1	1	1	1	

Explain the result

We obtain a tautology, since for all the true implications in P1 and P2 we always obtain that the implication in Q is never false.

Question 1. [1.00 p] Formalize the following proposition in propositional Logic

S2: *" It suffices that I dance and sing so that I need either shoes or a guitar, and it is necessary that I dance and sing so that I need shoes or a guitar."*

MC = { da: dance, sg: sing, sh: need shoes, gu: need guitar }
S2 = { [$da \wedge sg \Rightarrow (sh \vee gu)] \wedge [(sh \vee gu) \Rightarrow da \wedge sg]$ }

Cuestión 2. [1.00 p] With respect to the proposition

P: "A program fails only If there is a bug and there is a design error"

we can say... **$pf \Rightarrow (bg \wedge de)$**

a)	P is always true when the program fails and there is a bug **(pf=1,bg=1) NO, if de=0**
b)	P can only be false if the program does not fail **(pf=0) NO because then P is always true**
c)	P is only true when there are neither bugs nore design errors, even if the program fails **(bg=0,de=0, pf=1) NO because when pf=1 then P is false.**
d)	P can be true even there is not a design error **(de=0) OK, whenever pf=0**

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Exercise 2 (2.50p). Study the validity the following reasoning **R2** using the **counter-example** method (refutation), and explain whether the reasoning is correct or not according to the results.

R2: *"Last night a band of thieves cracked a jewerly. The suspects are: Maki, Popeye and Pirate*
P1: *At least one of them is guilty*
P2: *Popeye is guilty only if It has a collaborator (at least one of the other two is guilty).*
P3: *Pirate is not guilty*
Q: *Maki is guilty*

MC = { **ma**: Maki guilty; **po:** Popeye guilty; **pi:** Pirate guilty }

Formalización

P1:____ma ∨ po ∨ pi ________________

P2:____po ⇒(ma ∨ pi)________________

P3:____¬pi__________

Q:______ma__________________

Application of the counter-example method

ma	**po**	**pi**	**P1:** ma ∨ po ∨ pi	**P2:** po ⇒(ma ∨ pi)	**P4:**¬pi	=>	**Q**: ma
			1	1	1		0
0		0	1				
0	1	0		CONTRADICTION since **po** must be 0			

a) Does **exist at least a counter-model interpretation?** YES NO

If NO please write the truth value of each atomic component of the proposition leading to a contradiction:

ma= 0 **po**= 1 **pi**= 0

b) Based on the obtained results, can you state that **R2** is: VALIDO NON VALID

Exercise 3 (1.50p). Given the following 3 premises, use natural deduction to obtain the conclusion.

1. **p ^ q** **Q: (m → t)**
2. **m v r → s**
3. **s v n → (p → t)**

Deduction *(use as many lines as needed)*

4. m (Hipotesis)	13.
5. m v r ID 4	14.
6. s MP 2,4	15.
7. s v n ID 6	16.
8. p → t MP 3,7	17.
9. p EC 1	18.
10. t MP 8,9	19.
11. t TD 4-10	20.
	21.

Ejercicio 4 (2.50p). In the following reasoning, use natural deduction to obtain Q.

1. **¬a v ¬b** **Q: (¬c v ¬d) v t**
2. **c → a**
3. **d → b**
4. **¬b^¬d → t**

Deducción *(utiliza tantas líneas como precises)*

5. ¬(¬c v ¬d) ^ ¬t (NC)	1. (¬c v ¬d) v t IN
6. c ^ d ^ ¬t De Morgan 5	1.
7. c ^ d EC 6	2.
8. c EC 7	3.
9. a MP 2,8	4.
10. ¬b SD 1,9	5.
11. ¬d MT 2,10	6.
12. ¬b^¬d IC 10,11	7.
13. t MP 4,12	8.
14. ¬t EC 5	9.
15. t^¬t IC 13, 14	