
EE1001

Foundations of Digital Techniques

Logic

Exercise 1

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Question 1

- $\mathbf{A} = \{4, 13, 14, 66, 70\}$, $\exists x \in \mathbf{A}$ such that x is an odd number. Determine whether the statement is T or F.

Question 2

- $\mathbf{A} = \{1, 2, 3\}$, $p: \forall x \in \mathbf{A}, x < 4$. Determine whether the statement is T or F.

Question 3

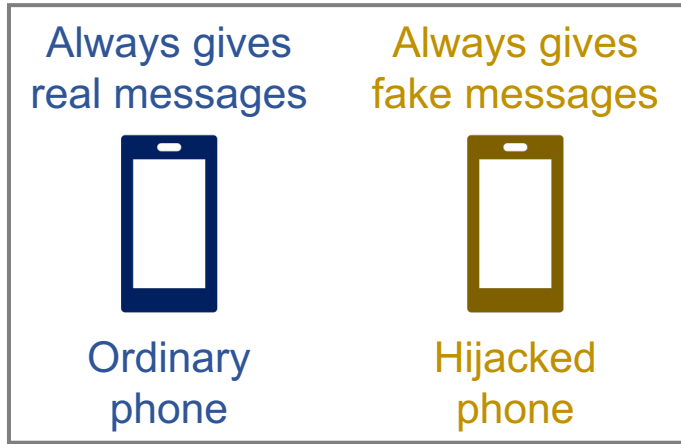
Write the negations of following statements.

i) $\forall n \in \mathbf{N}, n+1 > 2$

ii) $\forall x \in \mathbf{N}, x^2 + x$ is an even number

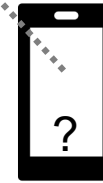
Question 4

There are two types of phones:



The Message given by A:

I am ordinary or hijacked.



A

Question:

Is A ordinary or hijacked? Use truth table to justify.

Question 5

There are two types of phones:

Always gives
real messages



Ordinary
phone

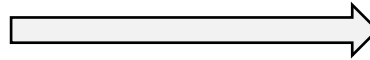
Always gives
fake messages



Hijacked
phone

Input Message:

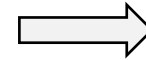
A is ordinary or hijacked.



A (hijacked)

Output Message:

?



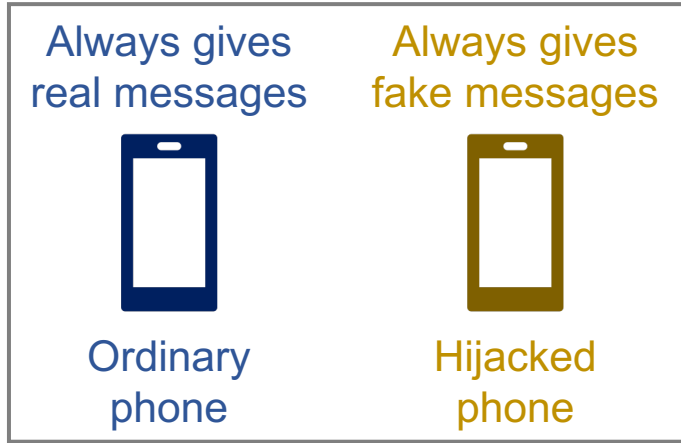
Question:

A is a hijacked phone, and my input message is
“A is ordinary or hijacked”.

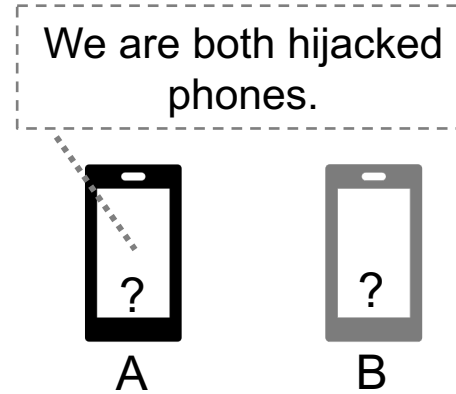
What message will A output?

Question 6

There are two types of phones:



The Message given by A:



Question:

Are A and B ordinary or hijacked? Use truth table to justify.

Question 7

Given two types of devices: normal and hijacked devices. The normal devices always give real (i.e., true) messages, and the hijacked devices always give fake (i.e., false) messages.

There are THREE (3) devices, and their messages are as follows.

Device A: “If Device *B* is hijacked, then Device *C* is also hijacked.”

Device B: “Devices *A* and *C* are hijacked.”

Device C: “This device could be normal or hijacked.”

Let *a*, *b*, and *c* be

a = “Device *A* is normal”

b = “Device *B* is normal”

c = “Device *C* is normal”

- (i) Formulate the messages of the devices using propositional logic.
- (ii) Using truth table to determine whether the devices *A*, *B*, and *C* are normal or hijacked.

Question 8

Determine the validity of the following arguments and brief the reasons.

- (i) If it rains today, we would not go swimming. We go swimming today. Therefore, it did not rain today.
- (ii) Alex is a history major. Thus, Alex is either an engineering major or a history major.
- (iii) If Smith plays football, then he will stay outside too long. If Smith stays outside too long, then he will get heatstroke. Therefore, if Smith plays football, he will get heatstroke.
- (iv) If I am tired and if I do not spend time on the mobile phone, then I will sleep early. I didn't sleep early. Therefore, I was not tired and I spent time on the mobile phone.
- (v) If Kate doesn't work hard, then she will fail in this course. If Kate doesn't fail in this course, then she will get the scholarship. Kate gets the scholarship. Therefore, Kate worked hard.