Quiz 2 - CS 393

1

$H \otimes I$

$\frac{1}{\sqrt{2}}$

$$H: \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & -1 & 0 \\ 0 & 1 & 0 & -1 \end{bmatrix}$$

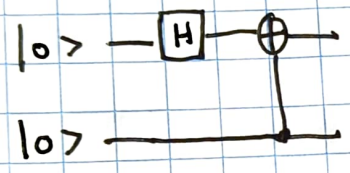
$$\text{CNoT}: \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 \end{bmatrix}$$

// Control on 2nd

Need Target on Second

$|0\rangle = \langle 1, 0$

2



WHK

6. Let $f : \{0,1\}^2 \longrightarrow \{0,1\}$ be a Deutsch-Jozsa oracle function (so f is assumed to be either constant or balanced) with the property that $f(00) = 1$ and $f(11) = 0$. Also suppose a quantum circuit implements f with three wires (as done in class). So the first two wires will accept a bit string s of length two converted to two kets (left to right becomes top to bottom on the wires) and last (bottom wire) is always given input $|0\rangle$. The last wire produces the output ket $|y\rangle$ so that the function takes value $f(s) = y$. Also, suppose that the circuit consists of blocks with combinations of X and CCNOT gates (as done in class) and contains the following block: a single X on the first wire, followed by a CCNOT, followed by an X again on the first wire. This information implies which of the following?

i) f is balanced ii) $f(01) = 1$ iii) $f(10) = 0$

a) TTF b) TFT c) TFF d) TTT e) FTT

MAT 399 **Quiz 2** **Fall 2025**

Quiz ID: WHK

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Answers:

1. b
2. a
3. b
4. c
5. b
6. c

Submit electronic answers at

http://azrael.digipen.edu/cgi-bin/MAT399quiz.pl