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**Student ID:**
**Date:**

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# EHB 205E: Introduction to Logic Design

## Quiz 1

*Duration: 30 Minutes*
*Grading: 1) 20%, 2) 40%, 3) 40%,*
*Quiz is in closed-notes and closed-books format*
*For your answers please use the space provided in the exam sheet*
*GOOD LUCK!*

**1.** Answer the following statements with T(true) or F(false) only.
(**do not guess**: points are deducted for wrong answers. If you do not know the answer, leave it blank)

**a)** F Finite decimal fraction can be always converted to finite binary fraction

**b)** T Finite hexadecimal fraction can be always converted to finite binary fraction

**c)** T (The population of Burundi was below 1 million in 2013) NAND (banana is tastier than apple)

**d)** F A circuit performing a binary addition of two $n$-bit numbers needs $n$ outputs.

**e)** T A circuit performing a binary multiplication of two $n$-bit numbers needs $2n$ outputs.

2-)

| $x_1x_2$ \ $x_3x_4$ | 00 | 01 | 11 | 10 |
|---|---|---|---|---|
| 00 | 0 | 1 | 1 | 0 |
| 01 | 1 | 1 | 0 | 0 |
| 11 | 1 | 1 | 1 | 1 |
| 10 | 0 | 1 | 1 | 0 |

$f = x_2\bar{x}_3 + x_1x_2 + \bar{x}_2x_4$

Prime implicants: $x_2\bar{x}_3$, $x_1x_2$, $\bar{x}_2x_4$, $x_1x_4$, $\bar{x}_3x_4$

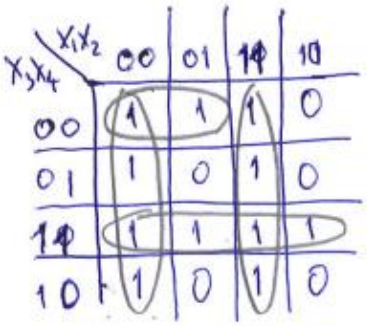
Essential Prime Imp.: $x_2\bar{x}_3$, $x_1x_2$, $\bar{x}_2x_4$

**3.** Obtain a minimal sum-of-products (SOP) expression for $f$ using a **Karnaugh** map.

$$f = \overline{x_1\,\overline{x_2}\,\overline{x_3} + x_1\,\overline{x_2}\,\overline{x_4} + \overline{x_1}x_2x_3\overline{x_4} + \overline{x_1}x_2\,\overline{x_3}\,x_4}$$

Truth Table

| $X_1$ | $X_2$ | $X_3$ | $X_4$ | $f$ |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 |
| 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 0 | 1 |
| 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 0 | 0 | 1 |
| 0 | 1 | 0 | 1 | 0 |
| 0 | 1 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 1 | 0 |
| 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 |




$f = \bar{X}_1\bar{X}_2 + X_1X_2 + X_3X_4 + \bar{X}_1\bar{X}_3\bar{X}_4$