**Student Names: Ufuk Arslan, Bilal Tekin**

**Student IDs: 2017400219, 2017400264**

**Group ID: 20**

**Session ID: FF 12**

**CMPE 240 2020 Experiment 2 Preliminary Work**

* **Truth Table**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **#** | **u** | **r** | **g** | **x** | **s** |
| **0** | 0 | 0 | 0 | 0 | 0 |
| **1** | 0 | 0 | 0 | 1 | 1 |
| **2** | 0 | 0 | 1 | 0 | 0 |
| **3** | 0 | 0 | 1 | 1 | 1 |
| **4** | 0 | 1 | 0 | 0 | 0 |
| **5** | 0 | 1 | 0 | 1 | 1 |
| **6** | 0 | 1 | 1 | 0 | 0 |
| **7** | 0 | 1 | 1 | 1 | 1 |
| **8** | 1 | 0 | 0 | 0 | 0 |
| **9** | 1 | 0 | 0 | 1 | 1 |
| **10** | 1 | 0 | 1 | 0 | 1 |
| **11** | 1 | 0 | 1 | 1 | 1 |
| **12** | 1 | 1 | 0 | 0 | 1 |
| **13** | 1 | 1 | 0 | 1 | 1 |
| **14** | 1 | 1 | 1 | 0 | 1 |
| **15** | 1 | 1 | 1 | 1 | 1 |

* **Sum of Products (SOP)**

**s = (u'r'g'x) + (u'r'gx) + (u'rg'x) + (u'rgx) + (ur'g'x) + (ur'gx') + (ur'gx) + (urg'x') + (urg'x) + (urgx') + (urgx)**

* **Minimized SOP**

**s = (u'r'g'x) + (u'r'gx) + (u'rg'x) + (u'rgx) + (ur'g'x) + (ur'gx') + (ur'gx) + (ur'gx) + (urg'x') + (urg'x) + (urg'x) + (urgx') + (urgx') + (urgx) + (urgx) + (urgx) (identity)**

**s = x(u'r'g' + u'r'g + u'rg' + u'rg + ur'g' + ur'g + urg' + urg) + ur(g'x' + g’x + gx’ + gx) + ug(r’x’ + r’x + rx’ + rx) (distributivity)**

**s = x( g(u'r' + u'r + ur' + ur) + g’(u'r' + u'r + ur' + ur)) + ur(g(x’ + x) + g’(x’ + x)) + ug(r(x’ + x) + r’(x’ + x)) (****distributivity)**

**s = x((g + g’)(u'r' + u'r + ur' + ur)) + ur(g(x’ + x) + g’(x’ + x)) + ug(r(x’ + x) + r’(x’ + x)) (distributivity)**

**s = x((g + g’)(u'(r' + r)+ u(r' + r)) + ur(g(x’ + x) + g’(x’ + x)) + ug(r(x’ + x) + r’(x’ + x)) (distributivity)**

**s = x((g + g’)(u' + u)(r' + r)) + ur((g + g’)(x’ + x)) + ug((r + r’)(x’ + x)) (distributivity)**

**s = x((1)(1)(1)) + ur((1)(1)) + ug((1)) (complement)**

**s = x + ur + ug (identity)**

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* **Product of Sums (POS)**

**s = (u+r+g+x)(u+r+g'+x)(u+r'+g+x)(u+r'+g'+x)(u'+r+g+x)**

* **Minimized POS**

**(u+r+g+x)(u+r+g'+x)**

**----------------------------------------------**

**s = (u+r+g+x)(u+r+g'+x) => A = u+r+x, B = g**

**=(u+r+x+g)(u+r+x+g') (Commutativity)**

**= (A+B)(A+B') => (AA + AB' + BA + BB') (Distributivity)**

**=(AA + AB' + AB + BB') (Commutativity)**

**=(AA + A(B+B') + BB') (Distributivity)**

**=(AA + A(1) + 0) (Complement)**

**=(A + A) (Identity)**

**=(A) = (u+r+x) (Identity)**

**(u+r'+g+x)(u+r'+g'+x)**

**----------------------------------------------**

**=(u+r'+g+x)(u+r'+g'+x) => C = u + r' + x , D = g**

**=(u+r'+x+g)(u+r'+x+g') = (C + D)(C + D') (Commutativity)**

**=(CC + CD' + DC + DD') (Distributivity)**

**=(CC + CD' + CD + DD') (Commutativity)**

**=(CC + C(D+D') + DD') (Distributivity)**

**=(CC + C(1) + 0) (Complement)**

**=(C + C) (Identity)**

**=(C) => u+r'+x (Identity)**

**s = (u+r+g+x)(u+r+g'+x)(u+r'+g+x)(u+r'+g'+x)(u'+r+g+x)**

**-----------------------------------------------------------------------**

**=(A)(C)(u'+r+g+x)**

**=(u+r+x)(u+r'+x)(u'+r+g+x)**

**= (u+r+x)(u+r'+x) => E = u+x , G = r**

**= (u+x+r)(u+x+r') => (E+G)(E+G') (Commutativity)**

**=(EE+EG'+GE+GG') (Distributivity)**

**=(EE+EG'+EG+GG') (Commutativity)**

**=(EE + E(G'+G)+GG') (Distributivity)**

**=(EE + E(1)+0) (Complement)**

**=(E+E) (Identity)**

**=(E) = u+x (Identity)**

**= (u+x)(u'+r+g+x)**

**=(uu'+ur+ug+ux+xu'+xr+xg+xx) (Distributivity)**

**=(uu'+ur+ug+ux+xu'+xr+xg+x) (Identity)**

**=(uu'+ur+ug+ux+xu'+xr+x) (Absorbtion)**

**=(uu'+ur+ug+ux+xu'+x) (Absorbtion)**

**=(uu'+ur+ug+ux+x) (Absorbtion)**

**=(uu'+ur+ug+x) (Complement)**

**=(ur+ug+x) (Complement)**

**Circuit**

