

- ✓ Manually carry out binary unsigned division of 110101 by 000101, showing all the steps that would take place in a sequential divider circuit. The quotient as well as the remainder should be expressed as 6 bit unsigned numbers.

[2]

2. Boolean expressions defining a combinational circuit with 4 inputs and 3 outputs are given below. Give realization for this circuit using a NOR-NOR PLA with 4 inputs, 3 outputs and only 5 product terms. Any number of inverters can be used at inputs and outputs.

$$x = a'b'd + ab'cd' + a'bd$$

$$y = ab'c' + a'b'cd' + abc'$$

$$z = a'b'c + ab'd' + b'cd' + bcd'$$

[3]

3. Design a parallel array multiplier for multiplying two 4 bit unsigned numbers and producing a 4 bit product using carry save addition. The multiplier has another output to indicate overflow. For example, multiplying 3 and 4 will give the product = 12 and overflow = 0, whereas multiplying 10 and 7 will give product = 6 (i.e., 70 mod 16) and overflow = 1. You can use full adders and two input gates of any type. Try to use as few adders and gates as possible. [3]

[3]

4. Why is a transmission gate built using two transistors - one NMOS and one PMOS. Why is it not good to use just one transistor. [2]

[2]

1A) 000101 110101

$C + C^2 + C^4$
 C
 $C + C^2 + C^4$
 $C^2 + C^4 + C^8$
 $C^4 + C^8 + C^{16}$
 $C^8 + C^{16} + C^{32}$
 $C^{16} + C^{32} + C^{64}$
 $C^{32} + C^{64} + C^{128}$
 $C^{64} + C^{128} + C^{256}$
 $C^{128} + C^{256} + C^{512}$
 $C^{256} + C^{512} + C^{1024}$
 $C^{512} + C^{1024} + C^{2048}$
 $C^{1024} + C^{2048} + C^{4096}$
 $C^{2048} + C^{4096} + C^{8192}$
 $C^{4096} + C^{8192} + C^{16384}$
 $C^{8192} + C^{16384} + C^{32768}$
 $C^{16384} + C^{32768} + C^{65536}$
 $C^{32768} + C^{65536} + C^{131072}$
 $C^{65536} + C^{131072} + C^{262144}$
 $C^{131072} + C^{262144} + C^{524288}$
 $C^{262144} + C^{524288} + C^{1048576}$
 $C^{524288} + C^{1048576} + C^{2097152}$
 $C^{1048576} + C^{2097152} + C^{4194304}$
 $C^{2097152} + C^{4194304} + C^{8388608}$
 $C^{4194304} + C^{8388608} + C^{16777216}$
 $C^{8388608} + C^{16777216} + C^{33554432}$
 $C^{16777216} + C^{33554432} + C^{67108864}$
 $C^{33554432} + C^{67108864} + C^{134217728}$
 $C^{67108864} + C^{134217728} + C^{268435456}$
 $C^{134217728} + C^{268435456} + C^{536870912}$
 $C^{268435456} + C^{536870912} + C^{1073741824}$
 $C^{536870912} + C^{1073741824} + C^{2147483648}$
 $C^{1073741824} + C^{2147483648} + C^{4294967296}$
 $C^{2147483648} + C^{4294967296} + C^{8589934592}$
 $C^{4294967296} + C^{8589934592} + C^{17179869184}$
 $C^{8589934592} + C^{17179869184} + C^{34359738368}$
 $C^{17179869184} + C^{34359738368} + C^{68719476736}$
 $C^{34359738368} + C^{68719476736} + C^{137438953472}$
 $C^{68719476736} + C^{137438953472} + C^{274877906944}$
 $C^{137438953472} + C^{274877906944} + C^{549755813888}$
 $C^{274877906944} + C^{549755813888} + C^{1099511627776}$
 $C^{549755813888} + C^{1099511627776} + C^{2199023255552}$
 $C^{1099511627776} + C^{2199023255552} + C^{4398046511104}$
 $C^{2199023255552} + C^{4398046511104} + C^{8796093022208}$
 $C^{4398046511104} + C^{8796093022208} + C^{17592186044416}$
 $C^{8796093022208} + C^{17592186044416} + C^{35184372088832}$
 $C^{17592186044416} + C^{35184372088832} + C^{70368744177664}$
 $C^{35184372088832} + C^{70368744177664} + C^{140737488355328}$
 $C^{70368744177664} + C^{140737488355328} + C^{281474976710656}$
 $C^{140737488355328} + C^{281474976710656} + C^{562949953421312}$
 $C^{281474976710656} + C^{562949953421312} + C^{1125899906842624}$
 $C^{562949953421312} + C^{1125899906842624} + C^{2251799813685248}$
 $C^{1125899906842624} + C^{2251799813685248} + C^{4503599627370496}$
 $C^{2251799813685248} + C^{4503599627370496} + C^{9007199254740992}$
 $C^{4503599627370496} + C^{9007199254740992} + C^{18014398509481984}$
 $C^{9007199254740992} + C^{18014398509481984} + C^{36028797018963968}$
 $C^{18014398509481984} + C^{36028797018963968} + C^{72057594037927936}$
 $C^{36028797018963968} + C^{72057594037927936} + C^{144115188075855872}$
 $C^{72057594037927936} + C^{144115188075855872} + C^{288230376151711744}$
 $C^{144115188075855872} + C^{288230376151711744} + C^{576460752303423488}$
 $C^{288230376151711744} + C^{576460752303423488} + C^{1152921504606846976}$
 $C^{576460752303423488} + C^{1152921504606846976} + C^{2305843009213693952}$
 $C^{1152921504606846976} + C^{2305843009213693952} + C^{4611686018427387904}$
 $C^{2305843009213693952} + C^{4611686018427387904} + C^{9223372036854775808}$
 $C^{4611686018427387904} + C^{9223372036854775808} + C^{18446744073709551616}$
 $C^{9223372036854775808} + C^{18446744073709551616} + C^{36893488147419103232}$
 $C^{18446744073709551616} + C^{36893488147419103232} + C^{73786976294838206464}$
 $C^{36893488147419103232} + C^{73786976294838206464} + C^{147573952589676412928}$
 $C^{73786976294838206464} + C^{147573952589676412928} + C^{295147905179352825856}$
 $C^{147573952589676412928} + C^{295147905179352825856} + C^{590295810358705651712}$
 $C^{295147905179352825856} + C^{590295810358705651712} + C^{1180591620717411303424}$
 $C^{590295810358705651712} + C^{1180591620717411303424} + C^{2361183241434822606848}$
 $C^{1180591620717411303424} + C^{2361183241434822606848} + C^{4722366482869645213696}$
 $C^{2361183241434822606848} + C^{4722366482869645213696} + C^{9444732965739290427392}$
 $C^{4722366482869645213696} + C^{9444732965739290427392} + C^{18889465931478580854784}$
 $C^{9444732965739290427392} + C^{18889465931478580854784} + C^{37778931862957161709568}$
 $C^{18889465931478580854784} + C^{37778931862957161709568} + C^{75557863725914323419136}$
 $C^{37778931862957161709568} + C^{7555786$