

CO450 Computer Architectures Week 13 Exercise Handout

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Recap on Even and Odd Parity Checking

Using an **Even Parity Bit Check**, check the following data transmissions by adding your own parity bit in the empty column and ticking the appropriate result:

1	1	0	1	0	1	1	1	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>
0	1	1	1	0	1	1	0	1	Correctly Transmitted <input type="checkbox"/> Error Detected <input checked="" type="checkbox"/>
1	1	1	1	0	0	1	1	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>
1	1	0	0	0	1	0	1	1	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>

Using an **Odd Parity Bit Check**, check the following data transmissions by adding your own parity bit in the empty column and ticking the appropriate result:

0	0	1	0	0	1	1	0	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>
1	0	0	0	1	1	1	0	1	Correctly Transmitted <input type="checkbox"/> Error Detected <input checked="" type="checkbox"/>
1	0	1	1	0	1	1	1	1	Correctly Transmitted <input type="checkbox"/> Error Detected <input checked="" type="checkbox"/>
1	1	0	0	0	1	1	1	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>

Recap on Two-Dimensional Even Parity Scheme

Check the transmissions below with a Two-Dimensional Even Parity Scheme by adding your own parity bits to the rows and columns and ticking the appropriate result(s). If you do identify a single bit error reference which bit has the error by entering its Row and Bit Number e.g. R1 B0

1.

	B5	B4	B3	B2	B1	B0	
R1	1	1	0	0	0	0	0
R2	0	1	1	0	0	0	0
R3	1	0	1	1	1	1	1
R4	0	0	0	0	1	1	0
	0	0	0	1	0	0	1

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R3 B2

2.

	B5	B4	B3	B2	B1	B0	
R1	1	0	1	0	1	1	0
R2	0	1	0	1	1	0	1
R3	0	0	1	0	1	0	0
R4	0	1	0	1	1	1	0
	1	0	0	0	0	0	1

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R2 B5

Recap on Two-Dimensional Odd Parity Scheme

Check the transmissions below with a Two-Dimensional Odd Parity Scheme by adding your own parity bits to the rows and columns and ticking the appropriate result(s). If you do identify a single bit error reference which bit has the error by entering its Row and Bit Number e.g. R1 B0

1.

	B5	B4	B3	B2	B1	B0	
R1	1	1	0	0	1	0	0
R2	1	0	0	1	1	1	1
R3	1	0	0	1	1	0	0
R4	0	0	0	1	0	0	0
	0	0	1	0	0	0	1

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R2 B3

2.

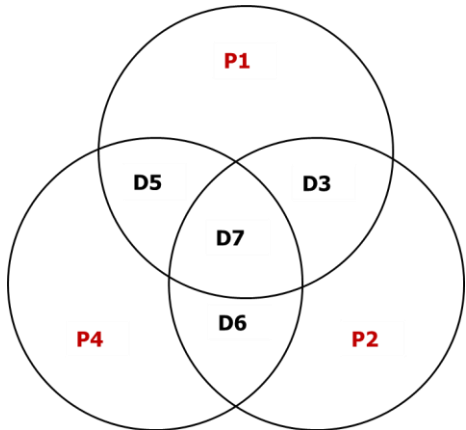
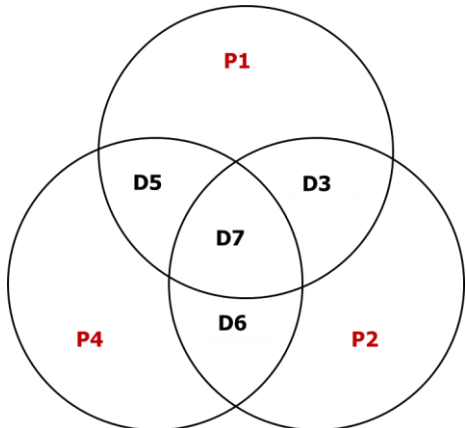
	B5	B4	B3	B2	B1	B0	
R1	0	1	0	1	1	0	0
R2	1	0	1	1	1	0	1
R3	0	1	0	1	0	1	0
R4	0	0	0	0	1	0	0
	0	1	0	0	0	0	

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R2 B4

The Hamming Code

Check the transmissions below by completing the Hamming Code diagram and table for each one and then ticking the appropriate result(s). If you do identify a single bit error, reference which bit has the error by entering its bit number e.g. D3

Codeword	Diagram	Table	Result																																
1111000		<table border="1"> <thead> <tr> <th>D7</th><th>D6</th><th>D5</th><th>P4</th><th>D3</th><th>P2</th><th>P1</th><th>Check</th></tr> </thead> <tbody> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	D7	D6	D5	P4	D3	P2	P1	Check																									Correctly transmitted <input type="checkbox"/> Error detected <input type="checkbox"/> Error can be corrected <input type="checkbox"/> Single Bit Error in: _____
D7	D6	D5	P4	D3	P2	P1	Check																												
1110001		<table border="1"> <thead> <tr> <th>D7</th><th>D6</th><th>D5</th><th>P4</th><th>D3</th><th>P2</th><th>P1</th><th>Check</th></tr> </thead> <tbody> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>	D7	D6	D5	P4	D3	P2	P1	Check																									Correctly transmitted <input type="checkbox"/> Error detected <input type="checkbox"/> Error can be corrected <input type="checkbox"/> Single Bit Error in: _____
D7	D6	D5	P4	D3	P2	P1	Check																												

0101001		<table><tr><th>D7</th><th>D6</th><th>D5</th><th>P4</th><th>D3</th><th>P2</th><th>P1</th><th>Check</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	D7	D6	D5	P4	D3	P2	P1	Check																																	Correctly transmitted <input type="checkbox"/> Error detected <input type="checkbox"/> Error can be corrected <input type="checkbox"/> Single Bit Error in: _____
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0010110		<table><tr><th>D7</th><th>D6</th><th>D5</th><th>P4</th><th>D3</th><th>P2</th><th>P1</th><th>Check</th></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>	D7	D6	D5	P4	D3	P2	P1	Check																																	Correctly transmitted <input type="checkbox"/> Error detected <input type="checkbox"/> Error can be corrected <input type="checkbox"/> Single Bit Error in: _____
D7	D6	D5	P4	D3	P2	P1	Check																																				

Gray Code to Binary Conversion

1. Convert the following gray code to binary and then from binary to decimal:

0010

We have worked this first question through for you.

Gray Code	0	0	1	0
Binary	0	0	1	1

The correct answer is:

3₁₀

2. Convert the following gray code to binary and then from binary to decimal:

0111

Gray Code				
Binary				

The correct answer is:

--

3. Convert the following gray code to binary and then from binary to decimal:

1101

Gray Code				
Binary				

The correct answer is:

--

4. Convert the following gray code to binary and then from binary to decimal:

1110

Gray Code				
Binary				

The correct answer is:

5. Convert the following gray code to binary and then from binary to decimal:

1001

Gray Code				
Binary				

The correct answer is:

6. Convert the following gray code to binary and then from binary to decimal:

0110

Gray Code				
Binary				

The correct answer is:

The Answers

Using an **Even Parity Bit Check**

1	1	0	1	0	1	1	1	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>
0	1	1	1	0	1	1	0	1	Correctly Transmitted <input type="checkbox"/> Error Detected <input checked="" type="checkbox"/>
1	1	1	1	0	0	1	1	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>
1	1	0	0	0	1	0	1	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>

Using an **Odd Parity Bit Check**

0	0	1	0	0	1	1	0	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>
1	0	0	0	1	1	1	0	1	Correctly Transmitted <input type="checkbox"/> Error Detected <input checked="" type="checkbox"/>
1	0	1	1	0	1	1	1	1	Correctly Transmitted <input type="checkbox"/> Error Detected <input checked="" type="checkbox"/>
1	1	0	0	0	1	1	1	0	Correctly Transmitted <input checked="" type="checkbox"/> Error Detected <input type="checkbox"/>

Two-Dimensional Even Parity Scheme

1.

	B5	B4	B3	B2	B1	B0	
R1	1	1	0	0	0	0	0
R2	0	1	1	0	0	0	0
R3	1	0	1	1	1	1	1
R4	0	0	0	0	1	1	0
	0	0	0	1	0	0	1

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R3 B2

2.

	B5	B4	B3	B2	B1	B0	
R1	1	0	1	0	1	1	0
R2	0	1	0	1	1	0	1
R3	0	0	1	0	1	0	0
R4	0	1	0	1	1	1	0
	1	0	0	0	0	0	1

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R2 B5

Two-Dimensional Odd Parity Scheme

1.

	B5	B4	B3	B2	B1	B0	
R1	1	1	0	0	1	0	0
R2	1	0	0	1	1	1	1
R3	1	0	0	1	1	0	0
R4	0	0	0	1	0	0	0
	0	0	1	0	0	0	0

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R2 B3

2.

	B5	B4	B3	B2	B1	B0	
R1	0	1	0	1	1	0	0
R2	1	0	1	1	1	0	1
R3	0	1	0	1	0	1	0
R4	0	0	0	0	1	0	0
	0	1	0	0	0	0	0

Correctly transmitted ☐
 Error detected ☒
 Error can be corrected ☒
 Single Bit Error in: R2 B4

The Hamming Code

1.

D7	D6	D5	P4	D3	P2	P1	Check
1		1		0		0	0
1	1			0	0		0
1	1	1	1				0

Correctly transmitted ☒Error detected ☐Error can be corrected ☐

Single Bit Error in: _____

2.

D7	D6	D5	P4	D3	P2	P1	Check
1		1		0		1	1
1	1			0	0		0
1	1	1	0				1

Correctly transmitted ☐Error detected ☒Error can be corrected ☒

Single Bit Error in: D5

3.

D7	D6	D5	P4	D3	P2	P1	Check
0		0		0		1	1
0	1			0	0		1
0	1	0	1				0

Correctly transmitted ☐Error detected ☒Error can be corrected ☒

Single Bit Error in: D3

4.

D7	D6	D5	P4	D3	P2	P1	Check
0		1		1		0	0
0	0			1	1		0
0	0	1	0				1

Correctly transmitted ☐Error detected ☒Error can be corrected ☒

Single Bit Error in: P4

Gray Code to Binary Conversion

1. 3_{10}

2. 5_{10}

3. 9_{10}

4. 11_{10}

5. 14_{10}

6. 4_{10}