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<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
<head>
<title>Educational Magic Tricks Based on Error-Detection Schemes, ITiCSE conference, July '17</title>
<meta http-equiv="Content-Type" content="text/html; charset=iso-8859-1" name = "keywords" />
<style>
table {float: left}
body {background-color: yellow; font-size:100%}
th {background-color: cyan}
.b1 {background-color: white}
.b0 {background-color: black}
.h0 {visibility: hidden}
p, input, td {color: magenta}
td {text-align: center}
</style>
<script type="text/javascript">
function gup(name) { /* For getting parameters from URL query string */
name = name.replace(/[\/, "\\\[ ]"/, "\\[ ]");
var regexS = "[\\?&]" + name + "=[^&#]*"; var regex = new RegExp( regexS );
var results = regex.exec( window.location.href );
if( results == null ) return ""; else return results[1];}
v=gup('v'); if (!v) v='1'; cheating=0; document.getElementsByTagName('title')[0].innerHTML += ' : Trick Version ' + v;
switch (v) { /* Branching on Version number of trick */
case '1': n=Number(gup('n')); if (!n) n=6; if (n<3) n=3; break;
case '2a': n=Number(gup('n')); if (!n) n=8; if (n<4) n=4; break;
case '2b': n=Number(gup('n')); if (!n) n=10; if (n<4) n=4; n=n+2-(n+1)%3; break; /* Upward to 1 mod 3 */
case '3': n=Number(gup('n')); n=10; cheating=1; break;
case '4': n=Number(gup('n')); n=11; cheating=1; break; /* Maybe allow other n later */
case '5': d=Number(gup('d')); if (!d) d=3; if (d<2) d=2; n=1; for (i=1;i<=d;i++) n=n*2; /* n is 2^d */
}
htmlw = document.getElementsByTagName('html')[0];
tilewidth = Math.floor(.67*htmlw.offsetWidth/n); tileheight = Math.max(7,tilewidth/2);
fontsize = .3*htmlw.offsetWidth/160;
btnfontsize = fontsize/3; tilefontsize = Math.max(2,tilewidth/64); headerfontsize = Math.max(0,tilewidth/64);
document.write('<style> p {font-size: '+fontsize+'em} </style>');
document.write('<style> input {font-size: '+btnfontsize+'em} </style>');
document.write('<style> td {font-size: '+tilefontsize+'em} </style>');
document.write('<style> th {font-size: '+headerfontsize+'em} </style>');
function oned2twod(cell) { return('Row '+Math.floor(cell/n)+' , Column '+cell%n); }
function twod2oned(row,col) { return(row*n+col); }
function bwgrid() { document.write('<table cellpadding="0" cellspacing="0"><tr><th></th></tr>');
for (col=0; col<n; col++) document.write('<th id="col'+col+'">'+col+'</th>');
document.write('</tr>'); cell=0;
for (row=0; row<n; row++) { document.write('<tr><th id="row'+row+'">'+row+'</th>');
for (col=0; col<n; col++) document.write('<td id="'+cell+++'" width="'+tilewidth+'px" height="'+tileheight+'px"
class="b'+Math.floor(2*Math.random())+'" onClick="flip(this)"></td>');
document.write('</tr>');}
document.write('</table>');
if (v=='1') { for (row=0; row<n; row++) document.getElementById(twod2oned(row,n-1)).className = 'h0';
for (col=0; col<n; col++) document.getElementById(twod2oned(n-1,col)).className = 'h0';
document.getElementById('col'+(n-1)).className = 'h0'; document.getElementById('row'+(n-1)).className = 'h0';}}
var fliprows = new Array(n); var flipcols = new Array(n); /* Rows/cols to flip; only need about n/2 or n/3 */
quotient35=0; remainder35=0; /* For v==3, need these and above arrays global to flip and organize */
function flip(tdelt) { /* Flips a tile as long as not locked out */
switch (phase) { /* Branch according to what stage of the trick we are at */
case 'testingLIFO':
if (tdelt==LIFOflip) {tdelt.innerHTML='YES.'; direlt.innerHTML = 'The wizard will reveal the other flip.';
phase='testingmain'; if (quotient35>0) {++drumnum; if (quotient35>1) ++drumnum; drumrolls();}}
else tdelt.innerHTML='NO.';
return;
case 'testingmain': if (tdelt==mainflip) tdelt.innerHTML='YES'; else tdelt.innerHTML='NO'; /* Falls through */
case 'lockout': return;
case 'mainflip': mainflip = tdelt; tdelt.innerHTML = 'Remember '+oned2twod(tdelt.id); phase='lockout';
if (cheating) direlt.innerHTML = 'Click the button below to generate organizing flips:<br /> <input type="button" value="Organize" onClick="organize()">';
else direlt.innerHTML = 'Click the button below to submit to wizard (who will tell the tile flipped):<br /> <input type="button" value="Submit" onClick="testwizard()">';
break;
case 'LIFOflip': LIFOflip = tdelt; tdelt.innerHTML = 'Remember also '+oned2twod(tdelt.id); phase='lockout';
direlt.innerHTML = 'Click the button below to submit to wizard (who will tell the tile flipped):<br /> <input type="button" value="Submit" onClick="testwizard()">';
break;
case 'organizing':
if (tdelt.innerHTML=='X') { tdelt.innerHTML=''; --num2organize;
if (num2organize==0) {
if (v!='4') { phase='mainflip'; if (v=='3') phase='LIFOflip';
direlt.innerHTML = 'Now click <em>one</em> tile of your own to flip.';}}
}
}
}

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else { direlt.innerHTML = 'Now the wizard will reveal your earlier flip.'; phase='testingmain';}}
else if (v==3) {
    document.getElementById(twod2oned(fliprows[3-num2organize],flipcols[3-num2organize])).innerHTML = "X";}}
else return;}
tdelt.className = 'b'+(1-tdelt.className.charAt(1));}
saveddirs=''; drumnum=0; /* Global to drumroll and endroll */
function drumrolls() { saveddirs = direlt.innerHTML; direlt.innerHTML += '<p>Drumroll please!';
--drumnum; setTimeout(endroll,6000);}
function endroll() {direlt.innerHTML = saveddirs; if (drumnum>0) setTimeout(drumrolls,5000);}
function testwizard() { tds = document.getElementsByTagName('td');
for (tdcount = 0; tdcount < tds.length; tdcount++) tds[tdcount].innerHTML = '';
phase='testingmain'; direlt.innerHTML = 'The wizard will tell the tile flipped.';
if (v=='3') { drumnum=1; setTimeout(drumrolls,2000); phase='testingLIFO';}}
function value(cell) { return(parseInt(document.getElementById(cell).className.charAt(1)));}
function calcrowpar(row) { parity = 0; rowstart=n*row; rowlim=rowstart+n;
for (cell=rowstart; cell<rowlim; cell++) parity ^= value(cell); return(parity);}
function calccolpar(col) { parity = 0; colstart=col; collim=n*n;
for (cell=colstart; cell<collim; cell+=n) parity ^= value(cell); return(parity);}
function organize() { phase='organizing';
switch (v) { /* Branching on Version number of trick */
case '1': for (row=0;row<n-1;row++) { document.getElementById(twod2oned(row,n-1)).className='b'+calcrowpar(row);}
for (col=0; col<n; col++) {document.getElementById(twod2oned(n-1,col)).className='b'+calccolpar(col);}
document.getElementById('col'+(n-1)).className = ''; document.getElementById('row'+(n-1)).className = '';
direlt.innerHTML = 'The wizard has added some tiles to make the array bigger. Now, while the wizard is not looking, click <em>one</em> tile to flip.';
phase='mainflip'; break;
case '2a': case '2b': case '3': var rowpar = new Array(n); var colpar = new Array(n); fliprowctr=0; flipcolctr=0;
for (row=0;row<n-1;row++) rowpar[row]=calcrowpar(row); for (col=0;col<n-1;col++) colpar[col]=calccolpar(col);
rowparsum = 0; colparsum = 0; rowparmaj = 0; colparmaj = 0; linespergroup=3; if (v=='2a') linespergroup=n-1;
for (line=0; line<n-1; line++) { rowparsum += rowpar[line]; colparsum += colpar[line]
if ((line+1)%linespergroup==0) { rowparmaj=0; colparmaj=0;
if (rowparsum>linespergroup/2) rowparmaj=1; if (colparsum>linespergroup/2) colparmaj=1;
rowparsum=0; colparsum=0;
for (gline=line+1-linespergroup; gline<=line; gline++) {
if (rowpar[gline]!=rowparmaj) fliprows[fliprowctr++]=gline;
if (colpar[gline]!=colparmaj) flipcols[flipcolctr++]=gline;}}}
if (v=='3') { quotient35 = Math.floor(mainflip.id/35); /* Will be communicated through number of drumrolls */
remainder35 = mainflip.id%35; /* Will be communicated through ordering of organizing flips */
sixplace=Math.floor(remainder35/6); oneplace=remainder35%6; /* Encoding of remainder35 in base 6 */
switch(fliprowctr) { /* sixplace will be encoded in order of flip rows */
case 2: fliprows[2]=n-1; /* Fall through */
case 3: /* Encode 0 to 5 by row order via: 0=0,1,2; 1=0,2,1; 2=1,0,2; 3=1,2,0; 4=2,0,1; 5=2,1,0 */
switch(sixplace) {
case 1: temp=fliprows[1]; fliprows[1]=fliprows[2]; fliprows[2]=temp; break;
case 3: temp=fliprows[0]; fliprows[0]=fliprows[2]; fliprows[2]=temp; /* flow through */
case 2: temp=fliprows[0]; fliprows[0]=fliprows[1]; fliprows[1]=temp; break;
case 4: temp=fliprows[0]; fliprows[0]=fliprows[1]; fliprows[1]=temp; /* flow through */
case 5: temp=fliprows[0]; fliprows[0]=fliprows[2]; fliprows[2]=temp; break;}
break;
case 0: fliprows[0]=n-1; /* flow through */
case 1: /* When fliprowctr<=1, encode sixplace by doubling a row */
if (fliprows[0]<=sixplace) sixplace++; fliprows[2] = (fliprows[1]=sixplace);}
switch(flipcolctr) { /* oneplace will be encoded in order of flip cols */
case 2: flipcols[2]=n-1; /* Fall through */
case 3: /* Encode 0 to 5 by row order via: 0=0,1,2; 1=0,2,1; 2=1,0,2; 3=1,2,0; 4=2,0,1; 5=2,1,0 */
switch(oneplace) {
case 1: temp=flipcols[1]; flipcols[1]=flipcols[2]; flipcols[2]=temp; break;
case 3: temp=flipcols[0]; flipcols[0]=flipcols[2]; flipcols[2]=temp; /* flow through */
case 2: temp=flipcols[0]; flipcols[0]=flipcols[1]; flipcols[1]=temp; break;
case 4: temp=flipcols[0]; flipcols[0]=flipcols[1]; flipcols[1]=temp; /* flow through */
case 5: temp=flipcols[0]; flipcols[0]=flipcols[2]; flipcols[2]=temp; break;}
break;
case 0: flipcols[0]=n-1; /* flow through */
case 1: /* When flipcolctr<=1, encode oneplace by doubling a col */
if (flipcols[0]<=oneplace) oneplace++; flipcols[2] = flipcols[0]; /* This line and next */
flipcols[0] = (flipcols[1]=oneplace);} /* unlike for sixplace so won't flip same cell twice */
num2organize=3; mainflip.innerHTML = '';
document.getElementById(twod2oned(fliprows[0],flipcols[0])).innerHTML = "X";
direlt.innerHTML = 'Please announce and perform the indicated flip.';
else { for (num2organize=0; num2organize<Math.max(fliprowctr,flipcolctr); num2organize++) {
nextrow = n-1; nextcol = n-1;
if (num2organize<fliprowctr) nextrow = fliprows[num2organize];
if (num2organize<flipcolctr) nextcol = flipcols[num2organize];
document.getElementById(twod2oned((num2organize<fliprowctr)?fliprows[num2organize]:n-1,(num2organize<
flipcolctr)?flipcols[num2organize]:n-1)).innerHTML = "X";}
if (num2organize>0) direlt.innerHTML = "The tiles with an X offend the wizard's sense of organization;<br /
> please click them to flip.";

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    else {phase='mainflip';
        direlt.innerHTML = 'The wizard is happy with this organization. Now, while the wizard is not looking, click <em>one</em> tile to flip.';}}
    break;
    case '4':
        document.getElementById(mainflip.id).innerHTML=''; /* Nums in next line: 5^{-1}=9 mod 11; 7^{-1}=8 mod 11 */
        document.getElementById(twod2oned((9*Math.floor(mainflip.id/n))%11,(8*(mainflip.id%n)%11))).innerHTML = "X";
        num2organize=1; direlt.innerHTML = 'Please announce and perform the indicated flip.'; break;
    case '5':
        var flipind = new Array(d); var parities = new Array(4); for (i=0;i<4;++i) parities[i]=0; divisor=1;
        for (dim=0; dim<d; dim++) { for (i=0;i<3;++i) parities[i]=0; for (cell=0; cell<n*n; cell++) {
            index = Math.floor(cell/divisor)%4; parities[index] = parities[index] ^ value(cell); }
            parsum=0; for (i=0;i<3;++i) parsum=parsum+parities[i]; flipind[dim]=3;
            for (i=0;i<3;++i) if (parities[i]!=Math.floor(parsum/2)) flipind[dim]=i; divisor = divisor*4;
            flipcell=0; for (dim=d-1; dim>=0; --dim) flipcell = flipcell*4 + flipind[dim];
            document.getElementById(flipcell).innerHTML = "X"; num2organize=1;
            direlt.innerHTML = "The tile with an X offends the wizard's sense of organization;<br /> please click it to flip.";}}
        function ready() { direlt.innerHTML = 'Click one tile that the wizard will reveal later:<br />'; phase='mainflip';}
    </script>
</head>
<body>

<h6></h6>
<script type="text/javascript">
bwgrid(); document.getElementsByTagName('h6')[0].innerHTML = 'Version '+v;
</script>
<p id='directions'></p>
<script type="text/javascript">
direlt = document.getElementById('directions'); phase='initial';
direlt.innerHTML = 'Click any tiles you would like to flip,<br /> or reload to randomize.<br /> Then click the button below:<br /> <input type="button" value=' + (cheating ? '"Ready" onClick="ready()"' : '"Organize" onClick="organize()"'>');
</script>

</body> </html>

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