Earth Engine Towns

Memory Game

This Memory Game Master will be the Tutorial 195 from maXbox Starter Series.

You can program a simple memory game in maXbox using its built-in Object Pascal (Delphi-like) scripting engine and the precompiled VCL components. maXbox even includes a proof-of-concept memory game example using a grid of bitmaps. [sourceforge][sourceforge]

What maXbox is

maXbox is a self-contained scripting tool, compiler, and source library in one executable. It uses an Object Pascal/Delphi engine (RemObjects PascalScript) with hundreds of precompiled units and over 1,400 examples.[blogs.embarcadero] [sourceforge][maxbox6.wordpress]

Memory game approach in maXbox

The documented approach uses a `TStringGrid`/`TDrawGrid` (or `QGrid` on Linux/CLX) filled with bitmap images to represent cards. The basic structure follows a typical game loop:[sourceforge][sourceforge]

1. Configure and open window – create the form and grid
2. Initialize resources – load card images, shuffle pairs
3. Register input callbacks – handle mouse clicks on grid cells
4. Event processing loop – manage game state (flipping, matching, scoring) [softwareschule]

Example structure

Here's a minimal runnable skeleton you can adapt in maXbox:

```
const OPENDELAY = 500;

var
  Form1: TForm;
  Grid1: TDrawGrid;
  cCards: array of Integer;  // card values
  Flipped: array of Boolean;
  FirstCard, SecondCard: Integer;
  MatchCount, TotalPairs: Integer;

procedure FormGridCreate(Sender: TObject);
var i, j, k: Integer;
begin
  TotalPairs:= 8;  // 4x4 grid = 16 cards
  SetLength(cCards, TotalPairs * 2 +0);
  SetLength(Flipped, TotalPairs * 2 +0);

  // Initialize pairs
  for i:= 0 to TotalPairs - 1 do begin
    cCards[i * 2]:= i;
    cCards[i * 2 + 1]:= i;
  end;

  // Shuffle cards
  Randomize;
  writ('debug ccards count: '+itoa(high(ccards)+1))
  for i:= High(cCards) downto 1 do begin
    j:= Random(i + 1);
    k:= cCards[i];
    cCards[i]:= cCards[j];
    cCards[j]:= k;
  end;
  grid1.Font.Style2:=fsBold2;
  Grid1.font.size:= 20;
  Grid1.font.name:= 'Wingdings'
  Grid1.ColCount:= 4;
  Grid1.RowCount:= 4;
  // No fixed header row !
  Grid1.FixedRows:= 0;
  Grid1.FixedCols:= 0;
  Grid1.DefaultColWidth:= 80;     //60
  Grid1.DefaultRowHeight:= 80;
  //Grid1.Font.Color:= clred;
  Grid1.Options:= Grid1.Options+ [goFixedVertLine,goFixedHorzLi
end;

procedure Grid1DrawCell(Sender: TObject; ACol, ARow: Integer;
```

```
                                                Rect: TRect; State: TGridDrav
var Index: Integer;
begin
  Index:= ARow * Grid1.ColCount + ACol;
  with Grid1.Canvas do begin
    Brush.Color:= clSilver;
    FillRect(Rect);
    if Flipped[Index] then begin
      TextOut(Rect.Left+22, Rect.Top+16, IntToStr(cCards[Index])
    end else
      TextOut(Rect.Left+ 22, Rect.Top+ 16, '*');  //or ?,!
  end;
end;

procedure Grid1SelectCell(Sender: TObject; ACol, ARow: Integer;
                                                  var CanSelect: Boo
var Index: Integer;
begin
  Index:= ARow * Grid1.ColCount+ ACol;
  if Flipped[Index] or (FirstCard >= 0) and (SecondCard >= 0) tl
    Exit;
  Flipped[Index]:= True;
  Grid1.Invalidate;

  if FirstCard < 0 then
    FirstCard:= Index
  else begin
    SecondCard:= Index;
    if cCards[FirstCard] = cCards[SecondCard] then begin
      Inc(MatchCount);
      writ('debug found: '+itoa(matchcount));
      Grid1.Font.Color:= clgreen; //clyellow; //clnavy;
      if MatchCount = TotalPairs then
        ShowMessage('You got it Mem Master, Gewonnen!');
    end else begin
      // Delay unflip (use Timer in real implementation or sleep
      Flipped[FirstCard]:= False;
      Flipped[SecondCard]:= False;
      Grid1.Font.Color:= clblack;
      sleep(OPENDELAY)
      Grid1.Invalidate;
    end;
    FirstCard:= -1;
    SecondCard:= -1;
  end;
end;

procedure memoryMainRoutine;
begin
  Application.Initialize;
  Application.CreateForm(TForm1, Form1);
  Form1.Caption:= 'Memory Game by maXbox5';
  form1.setbounds(10,10,420,390)
  Grid1:= TDrawGrid.Create(Form1);
  Grid1.Parent:= Form1;
  Grid1.Align:= alClient;
  Grid1.OnDrawCell:= @Grid1DrawCell;
  Grid1.OnSelectCell:= @Grid1SelectCell;
  FirstCard:= -1;
  SecondCard:= -1;
  MatchCount:= 0;
  FormGridCreate(Form1);
  form1.show;
```

```
    //Application.Run;
  end;
```

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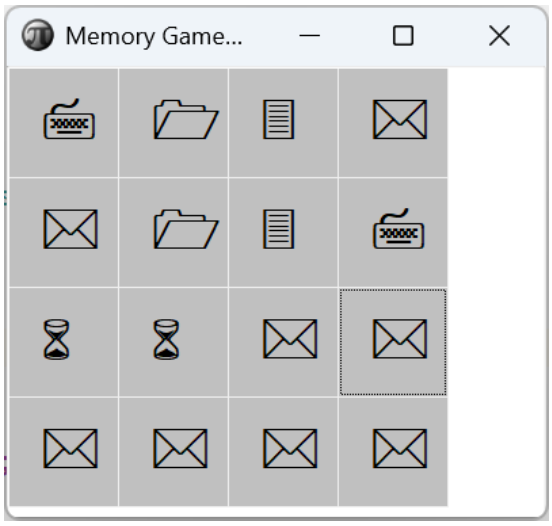
about

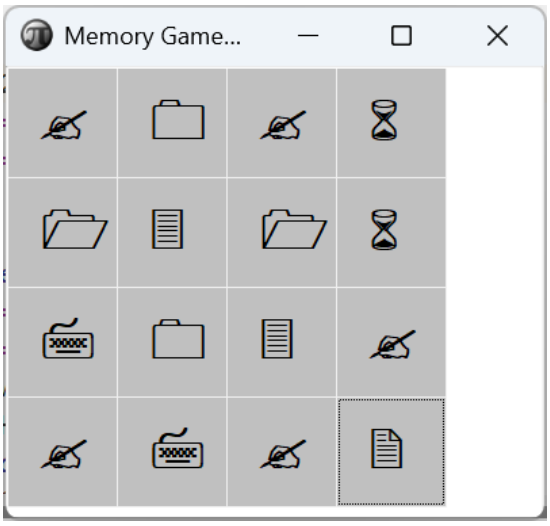
1. Download maXbox from SourceForge and unzip (preserve folder structure) [sourceforge][softwareschule]
2. Open maXbox, create a new script, paste the code above
3. Press F9 to compile and run[softwareschule][softwareschule]
4. Extend with actual bitmap images instead of text, add timers for flip delays, and scoring
5. We use the wingdings font as a straight graphical library

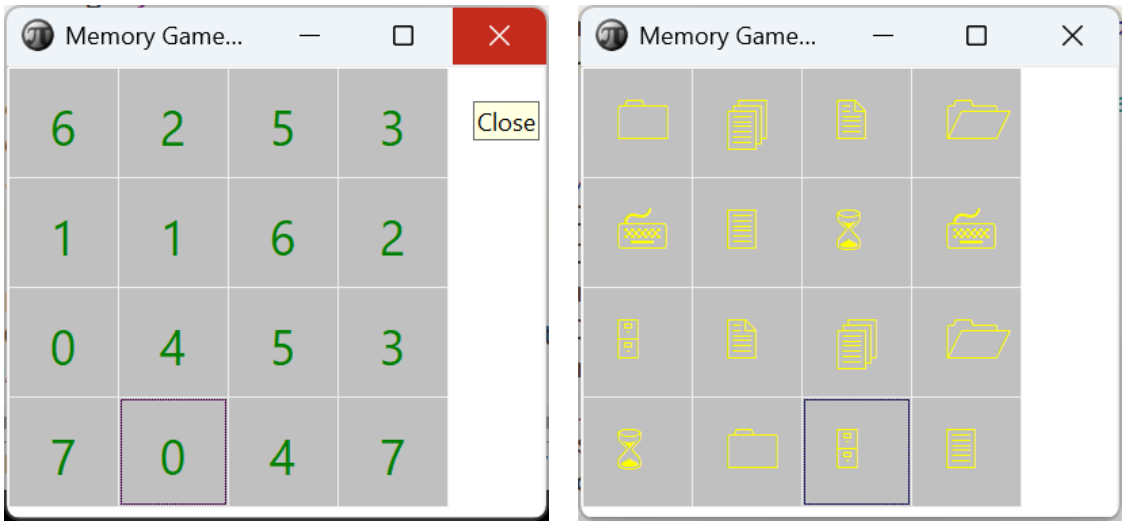
By changing the font.name or comment out

```
grid1.Font.Style2:=fsBold2;
Grid1.font.size:= 20;
Grid1.font.name:= 'Wingdings'
```

For more examples, browse the 1,415+ examples in maXbox or check the Pascal Education Program (PEP) examples on SourceForge.[sourceforge] [maxbox6.wordpress]







Memory Master Decks and Variants

https://sourceforge.net/projects/maxbox5/files/examples/1495_memorygame.txt/download

Note:
In Delphi, if you want to draw text in a TDrawGrid (or TStringGrid) with a custom font color, you need to handle the OnDrawCell event.
This event gives you a Canvas to draw on, where you can set Font.Color before calling TextOut or TextRect.

Key Points:

- Canvas.Font.Color — controls the text color.
- Canvas.Brush.Color + FillRect — paints the background.
- TextRect — draws text clipped to the cell rectangle.
- gdSelected — lets you detect if the cell is selected and adjust colors accordingly.

Avoid flicker — always fill the background before drawing text.

✅

If you want different colors per cell, just add conditions on ACol and ARow inside OnDrawCell.

In Delphi, a TDrawGrid does not have a built-in "header row" like TStringGrid does — it's just a blank canvas for you to draw cells.
If you want the first row to be treated as normal data (not as a header), you simply need to:

Set FixedRows to 0 in the Object Inspector or in code.

```
// No fixed header row !
Grid1.FixedRows:= 0;
Grid1.FixedCols:= 0;
```


Adjust your OnDrawCell logic so that it draws all rows the same way.

FormGridCreate() Explainer

This procedure `FormGridCreate` initializes and configures a 4×4 memory game grid in maXbox. Here's what it does, section by section:

Array initialization

```
TotalPairs := 8;  // 4x4 grid = 16 cards
SetLength(cCards, TotalPairs * 2 + 0);
SetLength(Flipped, TotalPairs * 2 + 0);
```

- Sets up 8 pairs (16 cards total)
- Allocates dynamic arrays `cCards` (card values) and `Flipped` (visibility state) [dev][scribd]

Card value assignment

```
for i := 0 to TotalPairs - 1 do begin
  cCards[i * 2] := i;
  cCards[i * 2 + 1] := i;
end;
```

Creates matching pairs: cards at positions 0–1 get value 0, positions 2–3 get value 1, etc.

Shuffling (Fisher-Yates algorithm)

```
Randomize;
writ('debug ccards count: ' + itoa(high(ccards) + 1))
for i := High(cCards) downto 1 do begin
  j := Random(i + 1);
  k := cCards[i];
  cCards[i] := cCards[j];
  cCards[j] := k;
end;
```

- `Randomize` seeds the random number generator
- `writ` outputs a debug message (maXbox's console output function) [maxkleiner1.medium]
- `itoa` converts the integer count to a string for display[dev][cplusplus]

- The loop implements an in-place shuffle by swapping each card with a random earlier position

Grid visual configuration

```
grid1.Font.Style2 := fsBold2;
Grid1.font.size := 20;
Grid1.font.name := 'Wingdings'
Grid1.ColCount := 4;
Grid1.RowCount := 4;
Grid1.FixedRows := 0;
Grid1.FixedCols := 0;
Grid1.DefaultColWidth := 80;
Grid1.DefaultRowHeight := 80;
Grid1.Options:= Grid1.Options+[goFixedVertLine,goFixedHorzLine,goVe
```

- Sets font to bold Wingdings at size 20 (Wingdings renders numbers as symbols, useful for card icons)
- Creates a 4×4 grid with 80×80 pixel cells
- Removes fixed header rows/columns (`FixedRows := 0`, `FixedCols := 0`)
- Enables grid lines for visual separation between cells

Note on syntax

There's a missing semicolon after `'Wingdings'` — it should be:

```
Grid1.font.name := 'Wingdings';
```

This procedure is typically called from `FormCreate` or similar initialization code to set up the game board before the player starts clicking cards.

Wingdings Explainer

In the memory game code, Wingdings is used as a symbol font where each card's numeric value (0–7) is displayed as a distinct pictogram instead of a number. [en.wikipedia][text-case]

How it works

When you set:

```
Grid1.Font.Name:= 'Wingdings';
Grid1.Font.Size:= 20;
```

and then draw a number like `0`, `1`, `2`, etc. on the grid cell, Wingdings renders those ASCII codes as symbols:

Card value	ASCII char	Wingdings symbol	Description
0	`0`	☔	Umbrella with rain
1	`1`	☕	Hot beverage
2	`2`	☖	White shogi piece
3	`3`	☗	Black shogi piece
4	`4`	☘	Shamrock
5	`5`	❧	Reversed floral heart
6	`6`	☚	Left pointing index
7	`7`	☛	Right pointing index

[text-case][texttoolz][dcode]

Display logic in the game

In the `OnDrawCell` event (not shown in your snippet but implied), you'd render the card like this:

```
if Flipped[Index] then
  Grid1.Canvas.TextOut(Rect.Left+20, Rect.Top+20, Chr(Index+48)) //
else
  Grid1.Canvas.TextOut(Rect.Left + 20, Rect.Top + 20, '?');
```

- Hidden state: Shows `?` (question mark)
- Flipped state: Shows the Wingdings symbol for that card's value[wingdingstranslator][text-case]

Why Wingdings?

- No external images needed – symbols are built into the font

- **Consistent sizing** – scales with font size like text
- **Easy pairing** – numeric values 0–7 map directly to distinct symbols[en.wikipedia][text-case]

Alternative mappings

You could also use other ranges for more variety:

- A–H → ✌, ✍, ✈, ✉, ☺, ♣, ♠, ♦ (victory hand, writing hand, airplane, envelope, smiley, card suits)[text-case][texttoolz]
- Circled numbers ⓪–⑦ for a numbered look[text-case]

This approach is lightweight and works well for simple memory games without needing bitmap resources.

Flipped Array Logic

The `Flipped` array is a **boolean state tracker** that records which cards are currently face-up (visible) in the memory game.[docwiki.embarcadero][thoughtco]

Declaration and initialization

```
SetLength(Flipped, TotalPairs * 2 + 0);
```

This creates a dynamic boolean array with 16 elements (for a 4×4 grid). In Delphi/Object Pascal:

- Dynamic arrays are **zero-based** (indices 0–15)
- Boolean elements are initialized to `False` by default when allocated[docwiki.embarcadero][docwiki.embarcadero][docwiki.embarcadero]
- So initially, all 16 cards are face-down (not flipped)

How it's used in gameplay

The array works as a lookup table during the game loop:

State	`Flipped[Index]`	What the player sees
Face-down	`False`	Hidden symbol (e.g., `?`)
Face-up	`True`	Card symbol visible (Wingdings character)

Typical usage in `OnDrawCell`:

```
if Flipped[Index] then
  // Draw the card's symbol (Wingdings)
  Grid1.Canvas.TextOut(Rect.Left, Rect.Top, Chr(Cards[Index] + 48))
else
  // Draw hidden marker
  Grid1.Canvas.TextOut(Rect.Left, Rect.Top, '?');
```

Flipping logic

When a player clicks a cell:

```
procedure Grid1SelectCell(Sender:TObject;ACol,ARow:Integer;var CanS
var
  Index: Integer;
begin
  Index := ARow * Grid1.ColCount + ACol;

  // Prevent clicking already-flipped cards or during match-check d
  if Flipped[Index] then
    Exit;

  // Flip this card
  Flipped[Index] := True;
  Grid1.Invalidate;  // Triggers OnDrawCell to show symbol
  ...
end;
```

Match-checking flow

1. First click: `Flipped[FirstCard] := True`
2. Second click: `Flipped[SecondCard] := True`
3. Compare: If `Cards[FirstCard] = Cards[SecondCard]`, leave both `True` (permanently revealed)
4. No match: After a delay, set both back to `False` (hide again)[thoughtco] [drbob42]

Why a separate array?

You could store state in `Cards` (e.g., negative values for hidden), but a dedicated `Flipped` array:

- Keeps card values clean (0–7 for pairs)
- Makes logic clearer (`if Flipped[i]` is self-documenting)

- Allows easy extension (e.g., `FlippedOnce`, `MatchedCount`) [delphibasics.50webs][delphibasics.50webs]

The `+ 0` in `SetLength(Flipped, TotalPairs * 2 + 0)` is redundant—it's just `16`—but doesn't hurt.[docwiki.embarcadero][delphibasics.co]

How does Grid1SelectCell calculate the 1D index from grid coordinates?

`Grid1SelectCell` receives a cell's two-dimensional coordinates—column and row—and converts them into the position of that card in the one-dimensional arrays `cCards` and `Flipped`.

```
Index := ARow * Grid1.ColCount + ACol;
```

This is row-major order: all cards of row 0 come first, then all cards of row 1, and so on. Delphi grid coordinates are zero-based: the top-left card is column 0, row 0. [docwiki.embarcadero][docwiki.embarcadero]

Formula

```
\text{Index} = \text{ARow} \times \text{number of columns} + \text{
```

With four columns:

```
Index := ARow * 4 + ACol;
```

`ARow * 4` skips all cards in the rows above; `ACol` selects the card within the current row. This is the standard conversion from a two-dimensional grid coordinate to a one-dimensional array index.[stackoverflow][stackoverflow]

4×4 mapping

Grid cell	Calculation	Array index
(ACol=0, ARow=0)	0 * 4 + 0	0
(ACol=3, ARow=0)	0 * 4 + 3	3
(ACol=0, ARow=1)	1 * 4 + 0	4
(ACol=2, ARow=1)	1 * 4 + 2	6
(ACol=3, ARow=2)	2 * 4 + 3	11

Grid cell	Calculation	Array index
(ACol=3, ARow=3)	3 * 4 + 3	15

So the visual grid corresponds to the arrays like this:

```
Grid coordinates              cCards / Flipped index

(0,0) (1,0) (2,0) (3,0)      0   1   2   3
(0,1) (1,1) (2,1) (3,1)      4   5   6   7
(0,2) (1,2) (2,2) (3,2)      8   9  10  11
(0,3) (1,3) (2,3) (3,3)     12  13  14  15
```

Why it matters

After the calculation, both arrays use exactly the same index:

```
Index := ARow * Grid1.ColCount + ACol;

if not Flipped[Index] then begin
  Flipped[Index] := True;     // Reveal this clicked card
  writ(IntToStr(cCards[Index])); // Its matching-pair value
end;
```

For example, clicking the third column of the second row gives `(ACol=2, ARow=1)`, therefore `Index = 6`. The game reads `cCards[6]` to identify its symbol and changes `Flipped[6]` to decide whether that symbol should be drawn. [docwiki.embarcadero][docwiki.embarcadero]

Full Source Code

https://sourceforge.net/projects/maxbox5/files/examples/1495_memorygame.txt/download