



GameMaker: Studio

100 Programming Challenges

—
Ben Tyers

Apress®

GameMaker: Studio 100 Programming Challenges



Ben Tyers

GameMaker: Studio 100 Programming Challenges

Ben Tyers

Worthing, West Sussex, United Kingdom

ISBN-13 (pbk): 978-1-4842-2643-8

DOI 10.1007/978-1-4842-2644-5

ISBN-13 (electronic): 978-1-4842-2644-5

Library of Congress Control Number: 2017932374

Copyright © 2017 by Ben Tyers

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director: Welmoed Spahr

Lead Editor: Steve Anglin

Development Editor: Matthew Moodie

Technical Reviewer: Dickson Law

Coordinating Editor: Mark Powers

Copy Editor: Karen Jameson

Compositor: SPi Global

Indexer: SPi Global

Artist: SPi Global

Cover image designed by Freepik

Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a Delaware corporation.

For information on translations, please e-mail rights@apress.com, or visit www.apress.com.

Apress and friends of ED books may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Special Bulk Sales—eBook Licensing web page at www.apress.com/bulk-sales.

Any source code or other supplementary materials referenced by the author in this text are available to readers at www.apress.com/9781484226438. For detailed information about how to locate your book's source code, go to www.apress.com/source-code/.

Printed on acid-free paper

Contents

About the Author	xxi
About the Technical Reviewer	xxiii
Acknowledgments	xxv
Introduction	xxvii
■ Challenge 1: Maths Bar Graph	1
Notes on Approaching This Challenge	1
Guide	2
■ Challenge 2: Draggable and Movable Object	3
Notes on Approaching This Challenge	3
Guide	4
■ Challenge 3: Room Fade In and Out Transition	5
Notes on Approaching This Challenge	5
Guide	6
■ Challenge 4: Typewriter Text Effect	7
Notes on Approaching This Challenge	7
Guide	8
■ Challenge 5: Audio Volume Change Based on Distance	9
Notes on Approaching This Challenge	9
Guide	10
■ Challenge 6: Move Object to Position Using Path	11
Notes on Approaching This Challenge	11
Guide	12

■ Challenge 7: Make the Screen Shake	13
Notes on Approaching This Challenge	13
Guide	14
■ Challenge 8: Create Snow Effect	15
Notes on Approaching This Challenge	15
Guide	16
■ Challenge 9: Password Easter Egg	17
Notes on Approaching This Challenge	17
Guide	18
■ Challenge 10: Follow Two Objects in View	19
Notes on Approaching This Challenge	19
Guide	20
■ Challenge 11: High / Low Number Game	21
Notes on Approaching This Challenge	21
Guide	22
■ Challenge 12: Calculate the Average Position of Two Clicks	23
Notes on Approaching This Challenge	23
Guide	24
■ Challenge 13: Retrieve Text File from Web and Save Locally	25
Notes on Approaching This Challenge	25
Guide	26
■ Challenge 14: Shuffle Pack of Playing Cards and Deal 5	27
Notes on Approaching This Challenge	27
Guide	28
■ Challenge 15: Reverse Sentence Order	29
Notes on Approaching This Challenge	29
Guide	29

■ Challenge 16: Rotate and Move Object to Mouse Position	31
Notes on Approaching This Challenge	31
Guide	32
■ Challenge 17: Firework Display Using Effects	33
Notes on Approaching This Challenge	33
Guide	33
■ Challenge 18: Random Sentence Generator	35
Notes on Approaching This Challenge	35
Guide	36
■ Challenge 19: Pop-Up RPG Style Text Box	37
Notes on Approaching This Challenge	37
Guide	38
■ Challenge 20: Room Wrapping	39
Notes on Approaching This Challenge	39
Guide	40
■ Challenge 21: Sprite Shadow	41
Notes on Approaching This Challenge	41
Guide	41
■ Challenge 22: Make a Jukebox Player for Four Songs	43
Notes on Approaching This Challenge	43
Guide	44
■ Challenge 23: Scrolling Credits	45
Notes on Approaching This Challenge	45
Guide	46
■ Challenge 24: Random Dice Roller	47
Notes on Approaching This Challenge	47
Guide	48

■ Challenge 25: Substitution Cipher	49
Notes on Approaching This Challenge	49
Guide	50
■ Challenge 26: Save Highscore to INI	51
Notes on Approaching This Challenge	51
Guide	52
■ Challenge 27: Spawn Point	53
Notes on Approaching This Challenge	53
Guide	54
■ Challenge 28: Dictionary Check	55
Notes on Approaching This Challenge	55
Guide	56
■ Challenge 29: Draw Text with Shadow	57
Notes on Approaching This Challenge	57
Guide	58
■ Challenge 30: Classic Brick and Ball Game Remake	59
Notes on Approaching This Challenge	59
Guide	60
■ Challenge 31: Fire Projectile	61
Notes on Approaching This Challenge	61
Guide	62
■ Challenge 32: World Clock	63
Notes on Approaching This Challenge	63
Guide	64
■ Challenge 33: Text-Based Quiz	65
Notes on Approaching This Challenge	65
Guide	66

■ Challenge 34: Onscreen Keyboard	67
Notes on Approaching This Challenge.....	67
Guide	68
■ Challenge 35: Create a Drivable Tank That Leaves Tyre Tracks	69
Notes on Approaching This Challenge.....	69
Guide	70
■ Challenge 36: Parallax Background	71
Notes on Approaching This Challenge.....	71
Guide	72
■ Challenge 37: Click the Ghost	73
Notes on Approaching This Challenge.....	73
Guide	74
■ Challenge 38: Particle Fire Effect	75
Notes on Approaching This Challenge.....	75
Guide	76
■ Challenge 39: Bubble Sort	77
Notes on Approaching This Challenge.....	77
Guide	78
■ Challenge 40: Unlockable Levels Select Screen	79
Notes on Approaching This Challenge.....	79
Guide	80
■ Challenge 41: Moon Lander AI	81
Notes on Approaching This Challenge.....	81
Guide	82
■ Challenge 42: Dodge the Barrels	83
Notes on Approaching This Challenge.....	83
Guide	84

■ Challenge 43: Convert Celsius to Fahrenheit	85
Notes on Approaching This Challenge.....	85
Guide	86
■ Challenge 44: Dart Board Game	87
Notes on Approaching This Challenge.....	87
Guide	88
■ Challenge 45: Calculate BMI	89
Notes on Approaching This Challenge.....	89
Guide	90
■ Challenge 46: Colour Picker	91
Notes on Approaching This Challenge.....	91
Guide	92
■ Challenge 47: 10 Green Bottles	93
Notes on Approaching This Challenge.....	93
Guide	94
■ Challenge 48: English to Morse Code	95
Notes on Approaching This Challenge.....	95
Guide	96
■ Challenge 49: Blitz Game Remake	97
Notes on Approaching This Challenge.....	97
Guide	98
■ Challenge 50: Mini Golf Game Remake	99
Notes on Approaching This Challenge.....	99
Guide	100
■ Challenge 51: Rock, Paper, Scissors Game Remake	101
Notes on Approaching This Challenge.....	101
Guide	102

■ Challenge 52: Health Based on Distance	103
Notes on Approaching This Challenge	103
Guide	104
■ Challenge 53: Tank Trax Game Remake	105
Notes on Approaching This Challenge	105
Guide	106
■ Challenge 54: Two Separate Views	107
Notes on Approaching This Challenge	107
Guide	108
■ Challenge 55: Word Typing Game	109
Notes on Approaching This Challenge	109
Guide	110
■ Challenge 56: Destructible Terrain	111
Notes on Approaching This Challenge	111
Guide	112
■ Challenge 57: Duck Hunt Game Remake	113
Notes on Approaching This Challenge	113
Guide	114
■ Challenge 58: Keep Player in View	115
Notes on Approaching This Challenge	115
Guide	116
■ Challenge 59: Fizz Buzz	117
Notes on Approaching This Challenge	117
Guide	118
■ Challenge 60: Calculate Numbers	119
Notes on Approaching This Challenge	119
Guide	120

■ Challenge 61: Particle Trail Effect	121
Notes on Approaching This Challenge.....	121
Guide	122
■ Challenge 62: Draw a Rectangle and Calculate Area and Perimeter	123
Notes on Approaching This Challenge.....	123
Guide	124
■ Challenge 63: Tower Defense Game	125
Notes on Approaching This Challenge.....	125
Guide	126
■ Challenge 64: Drop the Coin AKA Plinko (Arcade Style)	129
Notes on Approaching This Challenge.....	129
Guide	130
■ Challenge 65: Calculate the Nth Result of Fibonacci Sequence	131
Notes on Approaching This Challenge.....	131
Guide	132
■ Challenge 66: Distance from Object to Mouse	133
Notes on Approaching This Challenge.....	133
Guide	134
■ Challenge 67: Convert Decimal to Binary, Oct, Hex, and Roman	135
Notes on Approaching This Challenge.....	135
Guide	136
■ Challenge 68: Text in X Box	137
Notes on Approaching This Challenge.....	137
Guide	138
■ Challenge 69: Frogger Game Remake	139
Notes on Approaching This Challenge.....	139
Guide	140

■ Challenge 70: Take a Screenshot	141
Notes on Approaching This Challenge.....	141
Guide	142
■ Challenge 71: Slowly Change Direction	143
Notes on Approaching This Challenge.....	143
Guide	144
■ Challenge 72: Pong Style Game Remake	145
Notes on Approaching This Challenge.....	145
Guide	146
■ Challenge 73: Shooting Gallery	147
Notes on Approaching This Challenge.....	147
Guide	148
■ Challenge 74: How Many of Each Letter	149
Notes on Approaching This Challenge.....	149
Guide	150
■ Challenge 75: Torpedo Game Remake	151
Notes on Approaching This Challenge.....	151
Guide	152
■ Challenge 76: One Hundred Random Numbers	153
Notes on Approaching This Challenge.....	153
Guide	154
■ Challenge 77: Coin Flip	155
Notes on Approaching This Challenge.....	155
Guide	156
■ Challenge 78: Predict the Path of an Object	157
Notes on Approaching This Challenge.....	157
Guide	158

■ Challenge 79: Dynamic Button	159
Notes on Approaching This Challenge	159
Guide	160
■ Challenge 80: Sokoban Game Remake	161
Notes on Approaching This Challenge	161
Guide	162
■ Challenge 81: Top Down Football	163
Notes on Approaching This Challenge	163
Guide	164
■ Challenge 82: Top Down Racing	165
Notes on Approaching This Challenge	165
Guide	166
■ Challenge 83: Convert Numbers (in Digits) to Words	167
Notes on Approaching This Challenge	167
Guide	168
■ Challenge 84: Zelda Style Views	169
Notes on Approaching This Challenge	169
Guide	170
■ Challenge 85: Convert Text File to eBook	171
Notes on Approaching This Challenge	171
Guide	172
■ Challenge 86: Planets Database (INI)	173
Notes on Approaching This Challenge	173
Guide	174
■ Challenge 87: How Much Flour	175
Notes on Approaching This Challenge	175
Guide	176

■ Challenge 88: Rotating Mini Map	177
Notes on Approaching This Challenge	177
Guide	178
■ Challenge 89: Selectable Troops	179
Notes on Approaching This Challenge	179
Guide	180
■ Challenge 90: Pipes	181
Notes on Approaching This Challenge	181
Guide	182
■ Challenge 91: Arcade Style Horse Race Game	183
Notes on Approaching This Challenge	183
Guide	184
■ Challenge 92: Road Builder	185
Notes on Approaching This Challenge	185
Guide	186
■ Challenge 93: Chess Board Representation	187
Notes on Approaching This Challenge	187
Guide	188
■ Challenge 94: 1945 Game Remake	189
Notes on Approaching This Challenge	189
Guide	190
■ Challenge 95: Create a Virtual ATM (Bank Teller)	191
Notes on Approaching This Challenge	191
Guide	192
■ Challenge 96: Moon Lander Game Remake	193
Notes on Approaching This Challenge	193
Guide	194

■ Challenge 97: Pixelate an Image	195
Notes on Approaching This Challenge	195
Guide	196
■ Challenge 98: Miner	197
Notes on Approaching This Challenge	197
Guide	198
■ Challenge 99: Follow Player (Ghost)	199
Notes on Approaching This Challenge	199
Guide	200
■ Challenge 100: Multiplication Table	201
Notes on Approaching This Challenge	201
Guide	202
■ Appendix A: Points Chart	203
Index	209

About the Author

Ben Tyers is a freelance programmer and technical writer by day and a sci-fi horror novel writer by night. He made his first computer game way back in 1984, on a ZX Spectrum 48K computer, when he was eight years old. His passion for creation has continued since then. He holds a number of computer-related qualifications. When relaxing, Ben has an infatuation for old-school horror and sci-fi films, particularly 1960s B-Movies.

Introduction

This book contains 100 programming challenges to test your prowess as a programmer in GameMaker: Studio's GML.

You do not have to start this book at the beginning; just delve in and select a challenge for the time you have available.

The task that needs to be completed is stated for each challenge. Each challenge has a difficulty rating, and is worth a set number of points. A level 1 challenge is worth 10 points; a level 2 is worth 20 points; up to level 5, which is worth 50 points. An estimated time to complete the challenge is stated, whether you gauge yourself as a beginner of GML, have a medium skill level, or consider yourself advanced. You only get points if you complete it within the allotted time.

In addition to the task page, each has a guide that provides some of the more important GML required for solving the task. You may use GameMaker: Studio's Help File (by pressing F1), which will not lose you any points. You may not search on the Internet.

Each task has an additional challenge, each of which carries 20 points. There is no time limit for this additional challenge.

There is a marking table at the back of the book that allows you to take note of your progress.

Each main challenge has a downloadable GMZ project file showing an example solution. There may be more than one way to solve a challenge.

All resources can be accessed by clicking the Download Source Code button at www.apress.com/9781484226438.

CHALLENGE 1



Maths Bar Graph

Challenge Outline

To accept 5 fieldnames / legends and numerical inputs (a value between 1 and 100), for each input. Display a bar graph showing each value graphically with the corresponding fieldname / legend under each.

Level 2



Beginner 3 Hours

Medium 1 Hour

Advanced 30 Minutes

Additional Challenge

Create an onscreen keyboard to allow appropriate data to be entered. Limit fieldname to between 1 and 20 characters, and check integer value is between 1 and 100. Allow user to specify colour of each bar graph element.

Points

In Time 20

Additional 20

Notes on Approaching This Challenge

For this you will need to figure out how to input text and variables in and how to draw text and rectangles using these inputs. A suitable method for storing the inputs would be a 2-dimensional array.

Electronic supplementary material The online version of this chapter ([doi:10.1007/978-1-4842-2644-5_1](https://doi.org/10.1007/978-1-4842-2644-5_1)) contains supplementary material, which is available to authorized users.

Guide

You can input data in using:

```
text=get_string("name","");
```

or

```
value=get_integer("integer",0);
```

You can draw a rectangle:

```
draw_rectangle(10,10,50,50,true);
```

where the values are x1,y1,x2,y2,outline

and the last value can be true or false for drawing outline or not.

You can format text, for example, the alignment, font style, and colour:

```
draw_set_halign(fa_center);  
draw_set_font(font_text);  
draw_set_colour(c_blue);
```

Note, that when you set drawing styles - including text alignment, font and colour - they will apply to all future drawings unless set otherwise.

You can repeat a block of code:

```
repeat(10)  
{  
  //repeats 10 times  
}
```

CHALLENGE 2



Draggable and Movable Object

Challenge Outline

Create an object with a sprite set. Allow instances of this object to be dragged using the left mouse button.

Level 1



Beginner 45 Minutes

Medium 30 Minutes

Advanced 12 Minutes

Additional Challenge

Create multiple instances. When releasing moved instance over another instance, place above it. If attempting to move from a location where multiple instances are present, only select and move the uppermost one.

Points

In Time 10

Additional 20

Notes on Approaching This Challenge

For this challenge you will need to check if the mouse cursor is over an instance. You can do this by checking the ID under the mouse position.

You will also need to compensate for the object's sprite origin.

Guide

You can check whether the mouse is over an instance using:

```
if position_meeting(mouse_x,mouse_y,id)
{
//do something
}
```

You can check for the initial mouse press using:

```
if mouse_check_button_pressed(mb_left)
{
//do something
}
```

You can check for continued pressing of a button:

```
if mouse_check_button(mb_left)
{
//do something
}
```

You can update the instance's position to the mouse coordinates:

```
x=mouse_x;
y=mouse_y;
```

CHALLENGE 3



Room Fade In and Out Transition

Challenge Outline

Create a system that fades a room to solid black, goes to a new room, and then fades from black to fully transparent.

Level 1



Beginner 25 Minutes

Medium 15 Minutes

Advanced 8 Minutes

Additional Challenge

Allow the option of setting the fade colour and speed.

Add 2 additional fade effects:

Scroll in from Side

Fade between Rooms

Points

In Time 10

Additional 20

Notes on Approaching This Challenge

You'll need to figure out how to draw a solid rectangle and set its alpha that changes over a number of steps.

Guide

You can set alpha for drawing functions using:

```
draw_set_alpha(value);
```

Where `value` is a value between 0 (transparent) and 1 (opaque)
For example:

```
draw_set_alpha(0.5);
```

Would set the transparency at 50%.

■ **Note** Apply alpha applies to all future drawing functions until set otherwise. You should set back to 1 when you're done so as not to affect unrelated drawing routines.

You can increase a value gradually each step, for example, by placing this in a Step Event:

```
value+=0.1;
```

This would increase by 0.1 per step.
You can decrease a value gradually each step, for example:

```
value-=0.1;
```

This would decrease by 0.1 per step.
You can draw a rectangle:

```
draw_rectangle(10,10,50,50,true);
```

where the values are `x1,y1,x2,y2,true/false`

Where last value can be true or false. True will only draw an outline; false will draw as a solid.
You can check if a value has exceeded another value:

```
if valuea>valueb  
{  
  //do something  
}
```

CHALLENGE 4



Typewriter Text Effect

Challenge Outline

To display a string one character at a time. Make a keyboard click sound as each new letter is shown.

Level 2



Beginner 45 minutes

Medium 30 Minutes

Advanced 8 Minutes

Additional Challenge

Allow bold and italic formatting and choice of text colour.

Points

In Time 20

Additional 20

Notes on Approaching This Challenge

For this task you'll need to figure out how to get a character from a string at a given position.

A good method for this is to take a character and add to a new string.

Use an alarm to allow a pause between characters being drawn. An audio file for the click sound is included in the resources pack.

Guide

You can set text to a string variable:

```
example="hello # world";
```

forces a line break

You can retrieve a single character at a position from a string:

```
string_char_at(text_to_write, i);
```

You can return the number of characters in a string:

```
length=string_length(example);
```

Playing audio is pretty straightforward:

```
audio_play_sound(snd_example,1,false);
```

CHALLENGE 5



Audio Volume Change Based on Distance

Challenge Outline

To change the volume of a music track depending on how far the player is from another object: the farther away, the lower the volume.

Level 2



Beginner 30 Minutes

Medium 20 Minutes

Advanced 8 Minutes

Additional Challenge

Create the same effect using audio emitters.
Create four music tracks, each playing in a corner of the room.
Make the falloff point at the room's center.

Points

In Time 20

Additional 20

Notes on Approaching This Challenge

There are a few ways to approach this. You could use the functions: `audio_play_sound_at` and `audio_listener_position`. Alternatively you could use `audio_emitter_*` functions. For this task we will use `audio_play_sound_at` and `audio_listener_position` for its simplicity.

Guide

You can use:

```
audio_play_sound_at(soundis,x,y,z,falloff_dist,falloff_max_dist,  
falloff_factor,loop,priority);
```

to play a sound at the given location.

You can create a listener using:

```
audio_listener_position(x, y, z);
```

Note that an improper up value (z) would reverse the channels.

For more advanced use, you can look at using `audio_listener_orientation`, which can be used to adjust the audio depending on the direction of the listener.

CHALLENGE 6



Move Object to Position Using Path

Challenge Outline

When the mouse right button is pressed, create a path that moves the player to a new position while avoiding obstacles.

Level 2



Beginner 1 Hour

Medium 30 Minutes

Advanced 8 Minutes

Additional Challenge

Cause the object to rotate to the path direction before moving. Then ensure the object is always pointing in direction it is moving.

Points

In Time 20

Additional 20

Notes on Approaching This Challenge

For this task you'll need to know basic `mp_grid_*` and `path_*` functions.

Guide

You can create a mp_grid using:

```
size=16;//set grid size
grid = mp_grid_create(0,0,ceil(room_width/size),ceil(room_height/size),size,size);
//create mpgrid;
```

You can add instances to avoid using:

```
mp_grid_add_instances(grid,obj_obstacle,1);
```

It's possible to overwrite with a new path:

```
mp_grid_path(grid,path,x,y,target_x,target_y,true);
```

You can create a path:

```
path=path_add();
```

And start an instance on a path:

```
path_start(path, 2, path_action_stop, true);
```

You should ensure that the path is not constantly set every step or won't move at all.

You can delete a path using `path_delete()`. You should do this at the Room End and destroy the instance if it is not persistent.