

Programming challenge

Bowling Score Board

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Inhaltsverzeichnis

Results.....	2
Satisfied.....	2
Not solved in Validation.....	2
Revalidation.....	2
Known limitations.....	3
References:.....	3
Assumptions.....	3
Assumptions: on Rules of Throwing Pins.....	3
Non-Scoring Related Assumptions.....	3
Assumptions: Scoring and Finalisation Related Rules.....	4
Rule about rendering.....	4
Rules about scoring and finalizing.....	4
UML Diagrams.....	6
UML Class-View.....	6
UML Detailed View.....	6
The Validation.....	7
Basic Issues.....	7
Initial window.....	7
Only Valid Pin Values are Accessible from the Toolbar.....	7
Basic Throws.....	7
The last frame.....	7
Strike behaviour.....	8
5 Strikes in a Row.....	8
Full Game of Strikes.....	8
Spare Behaviour.....	8
Validating with Scoring Specs from the Web.....	9
Validating against https://en.wikipedia.org	9
Validating against http://slocums.homestead.com	9
Validating the Multi Player Behaviour.....	10
Solved:.....	12
Problems:.....	12
Finalized Frames are NOT skipped in Cumulated Result.....	12
Screenshots.....	12
Revalidation.....	13
FIXED: FAULTY calculation of intermediate results:.....	13
Revalidating http://slocums.homestead.com	13

Results

- My „World Bowling SCORER“
features the full set of scoring rules of „World Bowling“
- **UML Diagrams** have been drawn in design phase and have been revised after final code refactoring. Both class view and detailed view is provided.
- These VALIDATION-STEPS have been taken:
 - ◆ Strike/Spare Scoring
 - ◆ Comparison with all available scoring resources (of the references)
 - ◆ Finally a validation to a reference scoring implementation from the web.
 - ◆ A problem showed up for rendering only “finalized” frame-scores
- A REVALIDATION has been necessary (see below).
 - ◆ Finally the full set of scoring rules is provided.

Satisfied...

- 1) The GUI:
 - a) Single and multiple player mode are allowed
 - b) Restarting and resetting the game is allowed
 - c) The thrown pins can be controlled from the toolbar of the main-window.
 - d) The handling is easy and stringent.
 - e) The active player and its frame is marked with a highlighted Box.
 - f) At the end the winner() are estimated and marked RED
- 2) The Scoring
 - a) the frame values are calculated correct
 - b) the thrown pin symbols are drawn correct.
 - c) The not-rendering (“hiding”) of frame-scores of NON finalized is working as it should.
 - d) the treatment of the last frame (the 10th frame) is working correct.
 - e) In the 2nd Draw also the resulting-score is calculated correct.

Not solved in Validation.

- 1) A problem occurred in the validation of my 1st Draw, (but has been fixed later on).
The web resource <https://www.bowlinggenius.com> shows this behaviour
 - NON finalized intermediate results ARE SKIPPED in calculating the total result on the very right.
 - NON finalized frame results ARE NOT SKIPPED in calculating the total sum.
During cumulating the players total score, non finalized results are NOT ignored
 - **Problem was fixed in code and a revalidation was started.**

Revalidation

Validation problem 1) has been fixed in the code.

A revalidation showed that it is really FIXED.

For details have a look in the last chapter

Known limitations

Besides these limitations, my solution is a **full featured World Bowling Scorer**.

But:

- The names of the Players cannot be personalized.
- The frame score boxes should be tightened and should NOT have any separating space.
- No unit-tests are provided. Testing has always been performed interactive via the GUI interface.
- No Help is available.
- A “reset” of the game makes the central widget flicker a little bit.

References

<https://www.wikihow.com/Score-Bowling>

<http://slocums.homestead.com/gamescore.html>

<https://www.bowlinggenius.com/>

[https://en.wikipedia.org/wiki/Strike_\(bowling\)](https://en.wikipedia.org/wiki/Strike_(bowling))

Assumptions

All rules given in the found references (see above) have to be fulfilled.
All examples have to be satisfied.

Assumptions: on Rules of Throwing Pins

- (a) Rules of throwing
 - i. at begin of each frame all 10 pins are on the table
 - ii. you have 2 throws to clear the table
 - iii. in the last frame (the 10th)
 - (a) a strike does not end the frame.
 - (b) you are a 3rd throw granted, if you gained any strike or spare in throw 1 or 2.

Non-Scoring Related Assumptions

The following shall apply.

- (b) The symbols are marked in each frame-score are used
 - i. a **Fault** is marked as „F“
 - ii. **0** pin is marked as „-“
 - iii. **1-9** pins is marked as „1“-“9“
 - iv. a **strike** is marked as „X“
 - v. a **spare** is marked as „/“
- (c) The symbol related to the count of the thrown pin is rendered to the symbol-positions 1, 2 (or 3 in the last frame).
- (d) The end of the game is detected automatically
 - i. the winner(s) results is/are retrieved
 - ii. there may be several winners when their score is the same
 - iii. score(s) of the winner(s) is/are is marked **RED**.

- (e) **GUI:**
 - i. The count of pins that will be thrown is steered via signal/slot mechanism
 - ii. The toolbars provides access throwing the pins via that mechanism
 - iii. only the amount of available pins can be thrown.
- (a) So, the toolbar hides all pin counts that would throw more than is on the table

Assumptions: Scoring and Finalisation Related Rules

Rule about rendering

- (f) The thrown symbols are symbolized
 - i. in the first line of the frame-score immediately
 - ii. either
 - (a) at the **regular-symbol-position** at the count of the throw of the frame
 - (b) or at the **2nd-symbol-position**
- (g) Each **frame-score** is rendered in he second line of the frame-score
 - i. **after the frame has been finalized.**

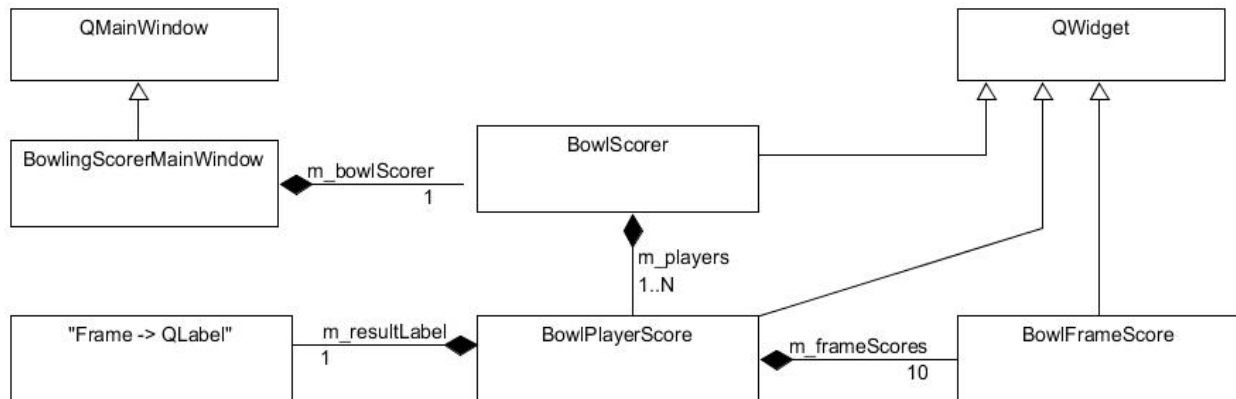
Rules about scoring and finalizing

- (h) the (intermediate) **end-result** is the the **total-score** of the last frame.
(That is equal to the total-score the last finalized frame).
- (i) finalization
 - i. The score of frame can he **finalized** or be on hold (be **not finalized**)
 - ii. All scores that have not started are not finalized.
- (j) Each score has a **basic-score** and an **extra -score** (a bonus for strikes and spares).
 - i. the **base-score**
 - (a) is the *pin-count of all throws of that frame*
 - ii. the **extra-score** is calculated **during finalizing** for strikes and spares only
- (k) the **total score of considered frame** is
 - i. *the total-score of a previous frame*, (if the frame is not the 1st)
 - ii. *and in case the considered frame has been finalized*
 - (a) *plus its base-score* and its **extra-score**
- (l) A **STRIKE** is a 10 (cleaning up) from the full table of pins
 - i. is rendered with a "X"
 - (a) for the last frame into the **regular-symbol -position**
 - (b) otherwise into the **2nd-symbol-position** field . The 1st field keeps empty.
 - ii. a **single-strike** //has 10 pins fallen and gets a basic-score of a 10
 - (a) ends that frame (no 2nd throw), if it is not the last frame.
 - (b) is finalized
 - (a) if that (next) frame is no strike.
 - (b) after the 2nd throw of the next frame.
 - (c) If it is finalized ,
 - (a) it's **extra-score** is the **count of pin1 plus pin 2** of the next frame
 - iii. a **double-strike** are two strikes not finalized in a row
 - (a) the **trailing**, the **oldest** of the two strikes
 - (a) is finalized if a following frame is finished and is is no strike.
 - (b) If it is finalized ,
 - (a) the **extra-score** of the **trailing strike**
 - (a) is the **count of pin1 + pin 2** of the following frame
 - (b) plus a **bonus of 10**
 - iv. a **triple-strike** are three not finalized strikes in a row
 - (a) the **trailing**, the **oldest** of the three strikes is **considered finalized**
 - (b) and gets an **extra-score** of 20
 - (c) the **remaining two strikes** are still not-finalized
 - (d) both are **ruled as a double-strike from now on.**

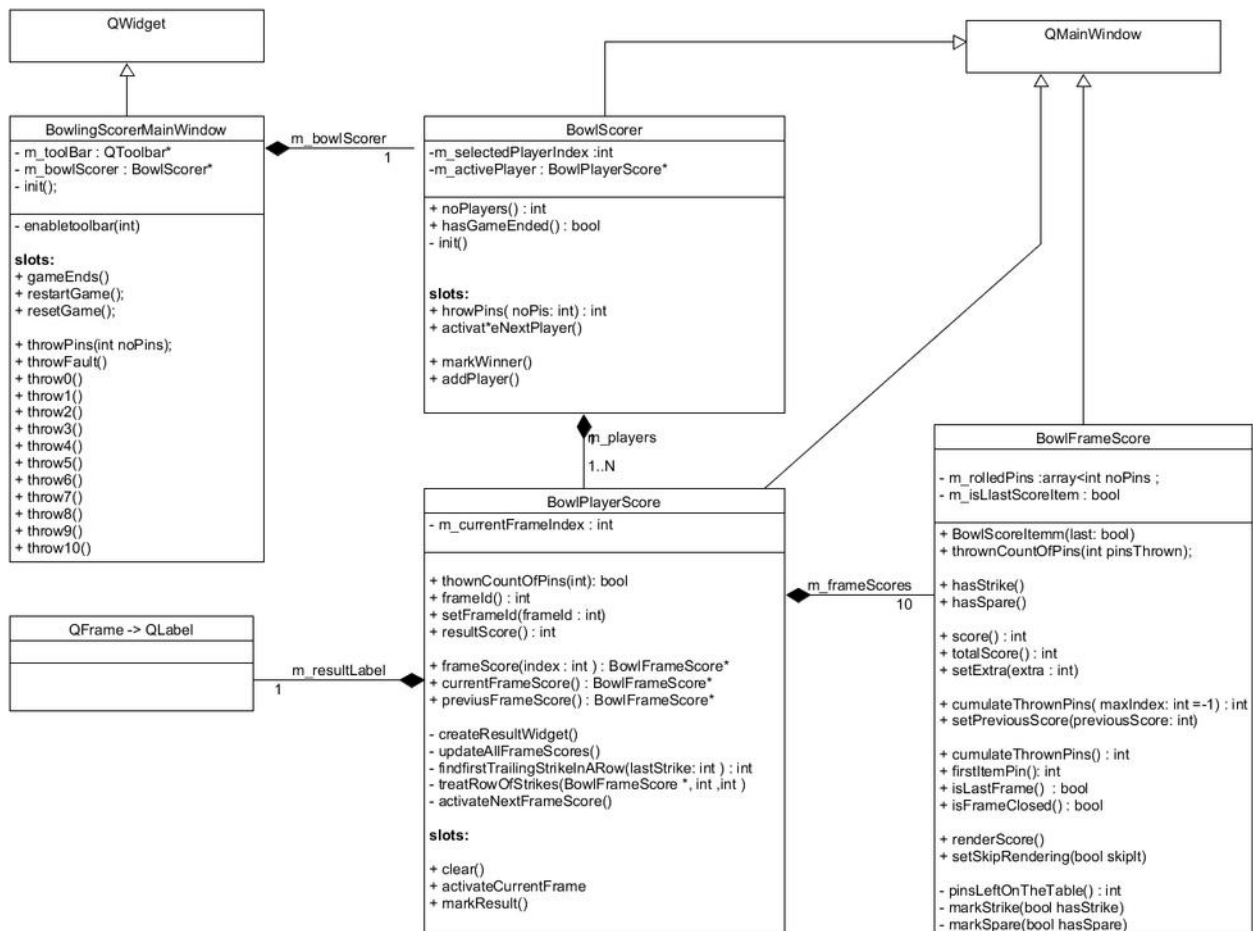
- (m) A **SPARE** is a throwing the last pin from table not in the first throw
- i. is rendered with a “/” into the **regular-symbol -position**.
 - ii. A spare /// has 10 pins fallen and gets a basic-score of a 10
 - (a) is finalized until the 1st throw of the following ext frame.
 - (b) If it is finalized,
 - (a) it gets a an **extra-score** of the 1st throw of the following frame
- (n) The **last frame**, (the 10th) has special rules :
- i. All rules related to finalization, strikes, and spare belonging to frame 1-9 apply (see below)
 - ii. there is **no extra-score** for the *last-frame*
 - iii. if ***in throw 1 or 2 there was a strike or spare*** .
 - (a) a **third throw** is allowed for the 10th frame.
 - (b) The last frame is **finalized after the 3rd throwing**
 - iv. otherwise 2 throws are allowed.
 - v. the **base-score for the last frame** is as always
the **count of all thrown pins** of that frame (**here up to 3 throws**)

UML Diagrams

UML Class-View



UML Detailed View

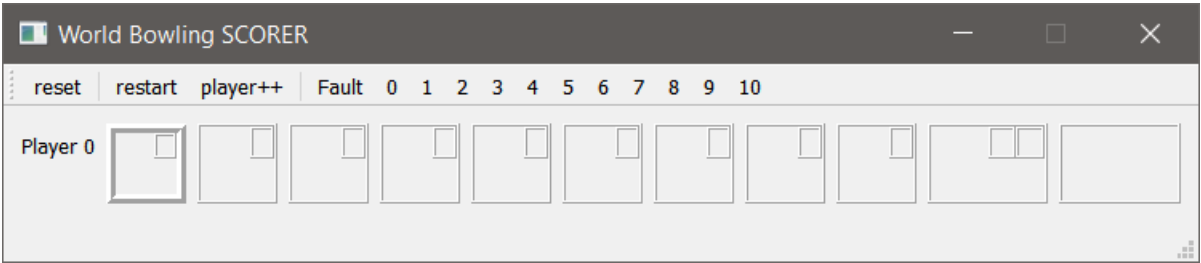


The Validation

Basic Issues

Initial window

It fulfils all needs of steering the bowling-scorer



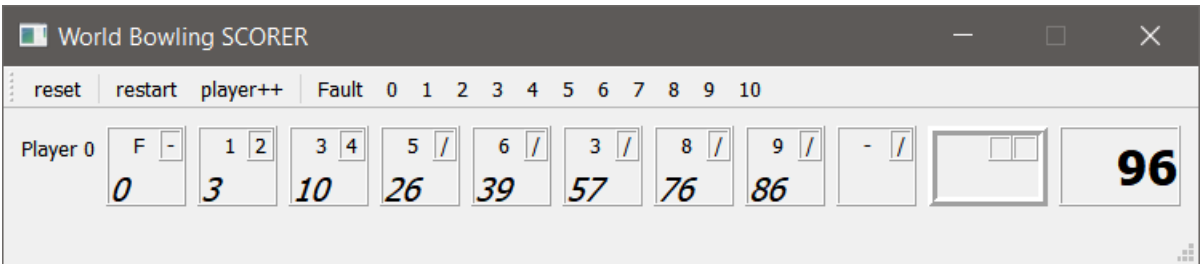
Only Valid Pin Values are Accessible from the Toolbar

After a 7 , only throwing fault, 0,,1, ,2 or 3 is selectable at the toolbar



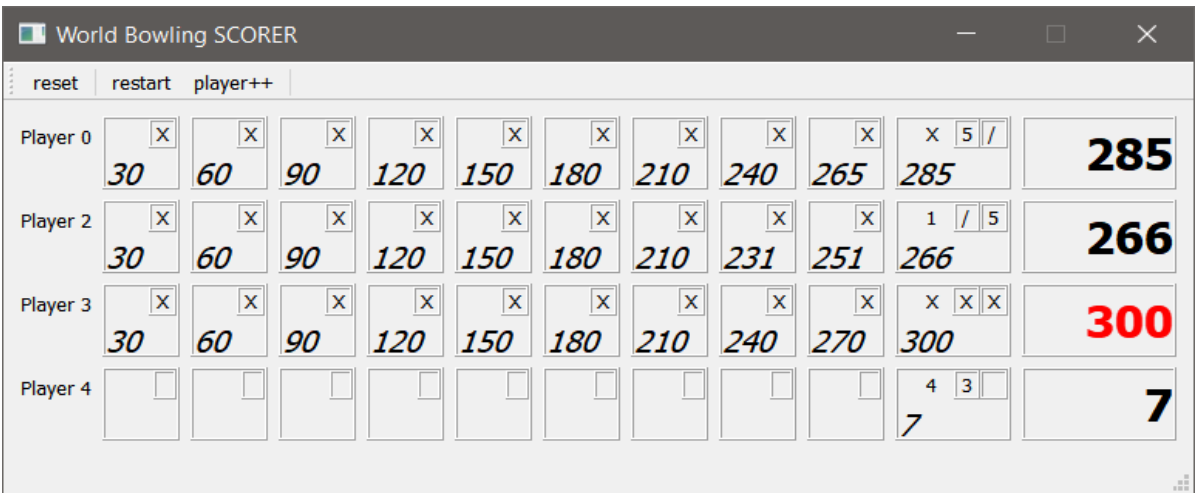
Basic Throws

Fault, 0, 1,2,3,4,, Spares of (5,5), (6,4) (3,7) (8,2, (9,1),(0,10)



The last frame

Some examples for scoring the the last frame. (at frame 9 a 4th player has been added)

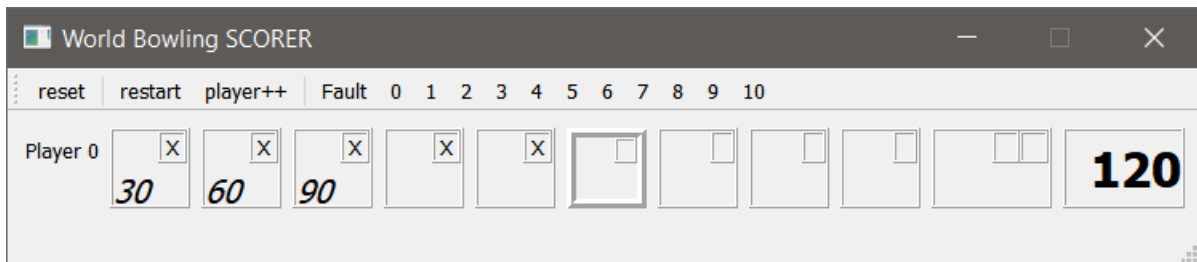


Strike behaviour

5 Strikes in a Row

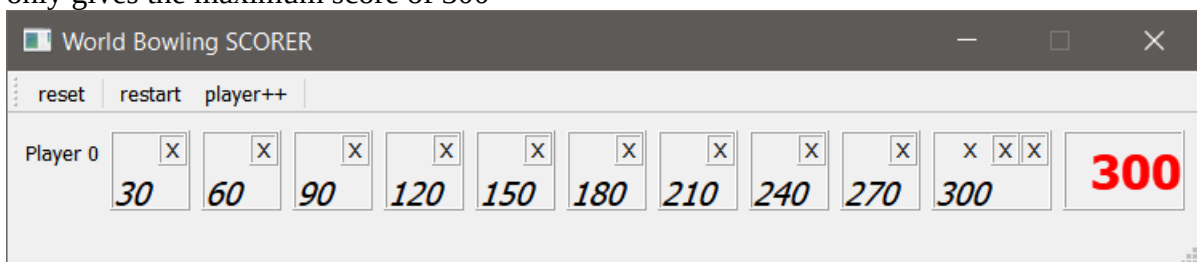
A strike or double strike is not finalized immediately.

A triple strike or more is scored with 30.



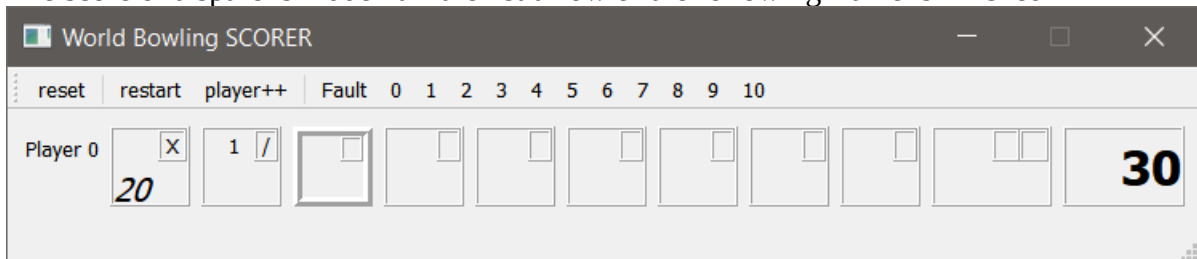
Full Game of Strikes

only gives the maximum score of 300

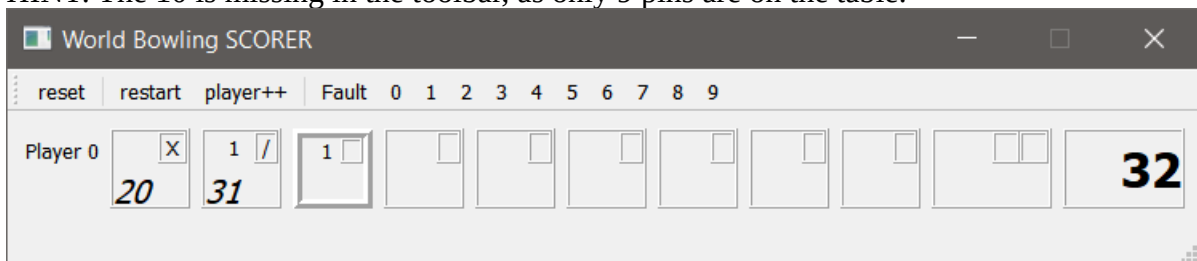


Spare Behaviour

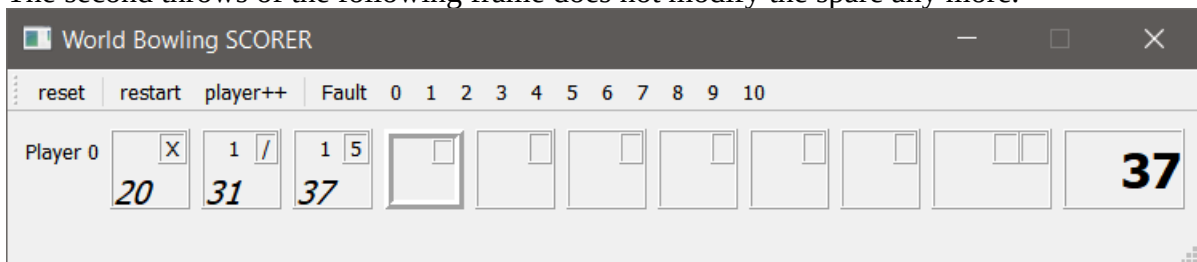
The score of a spare is hidden till the 1st throw of the following frame is finished



HINT: The 10 is missing in the toolbar, as only 9 pins are on the table.



The second throws of the following frame does not modify the spare any more.



Validating with Scoring Specs from the Web...

Validating against <https://en.wikipedia.org>

see [https://en.wikipedia.org/wiki/Strike_\(bowling\)](https://en.wikipedia.org/wiki/Strike_(bowling)))

	X		3	6		
19		28				

World Bowling SCORER

reset restart player++ Fault 0 1 2 3 4 5 6 7 8 9 10

Player 0

19 28 28

World Bowling SCORER

reset restart player++ Fault 0 1 2 3 4 5 6 7 8 9 10

Player 0

24 40 46 46

World Bowling SCORER

reset restart player++ Fault 0 1 2 3 4 5 6 7 8 9 10

Player 0

24 40 46 46

Validating against <http://slocums.homestead.com>

Taken from <http://slocums.homestead.com/gamescore.html>

1	2	3	4	5	6	7	8	9	10
X	7	9	X	-	8	8	F	6	X
20	39	48	66	74	84	90	120	148	167

World Bowling SCORER

reset restart player++

Player 0

20 39 48 66 74 84 90 120 148 167

1	2	3	4	5	6	7	8	9	10
X	7	9	X	-	8	8	F	6	X
20	39	48	66	74	84	90	117	136	145

World Bowling SCORER

reset restart player++

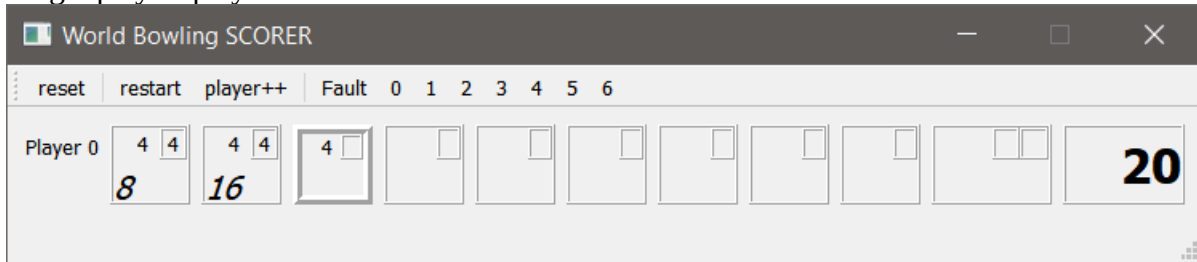
Player 0

20 39 48 66 74 84 90 117 136 145

Validating the Multi Player Behaviour

Herein only 4 pins are played, to reduce complexity,

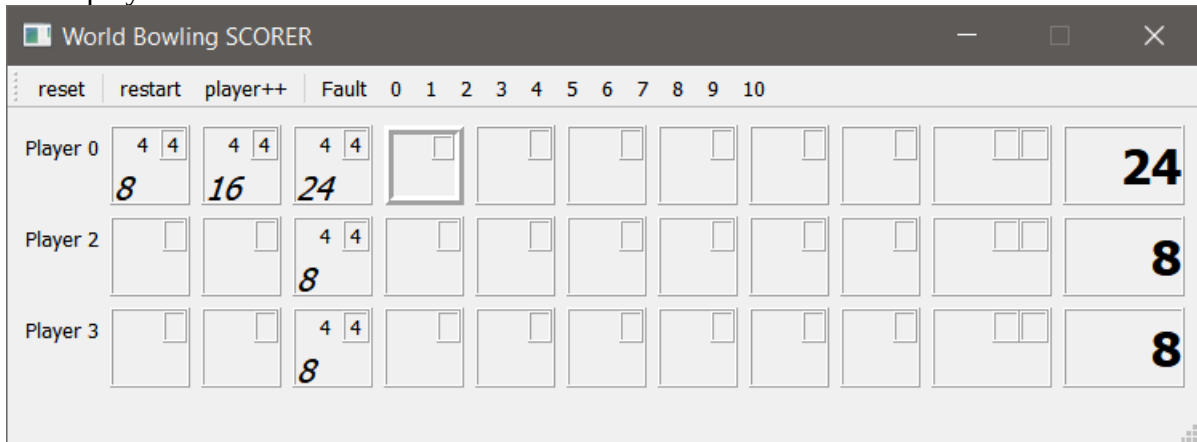
Single player plays till throw 2 of frame 3



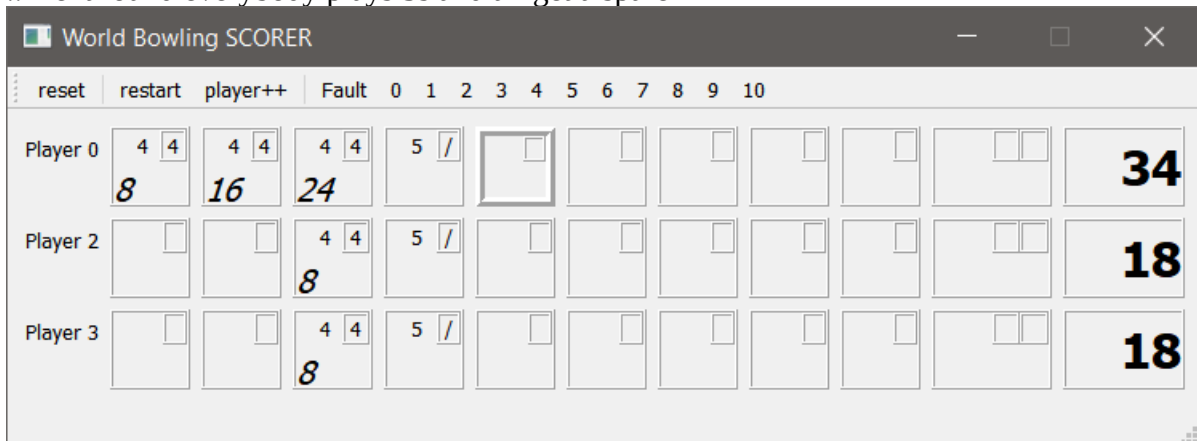
Single player adds 2 other players in frame 3



... all players closed their round with two times 4



.. Next round everybody plays 5s and all get a spare



the first two player play strikes, the last a foul and a 0

	reset	restart	player++	Fault	0	1	2	3	4	5	6	7	8	9	10	
Player 0					4	4	4	4	5	/	X					54
					8	16	24	44								
Player 2							4	4	5	/	X					38
							8	28								
Player 3							4	4	5	/	F -					18
							8	18	18							

till the last 10th frame (the last), only strikes are thrown

	reset	restart	player++	Fault	0	1	2	3	4	5	6	7	8	9	10	
Player 0					4	4	4	4	5	/	X	X	X	X	X	164
					8	16	24	44	74	104	134					
Player 2							4	4	5	/	X	X	X	X	X	148
							8	28	58	88	118					
Player 3							4	4	5	/	F -	X	X	X	X	108
							8	18	18	48	78					

in the last (the 10th) frame,

- player 1 rolled 2 strikes and had a 3rd turn
- player 2 rolled a spare of (1,9) and had a 3rd turn, too
- player 3 rolled a neither a spare or a strike in turn 1 and 2 and had NO 3rd turn.

	reset	restart	player++	Fault	0	1	2	3	4	5	6	7	8	9	10	
Player 0					4	4	4	4	5	/	X	X	X	X	X	219
					8	16	24	44	74	104	134	164	194	219		
Player 2							4	4	5	/	X	X	X	X	1 / 5	174
							8	28	58	88	118	139	159	174		
Player 3							4	4	5	/	F -	X	X	X	4 3	126
							8	18	18	48	78	102	119	126		

After the last frame has ben closed, the winner is estimated....

The winner is Player 1 !

Validation vs. reference implementation

Validating against a reference implementation from the web : www.bowlinggenius.com .

Solved:

The Symbols are shown correct

The frame score values are correct

The partially skipped rendering is correct.

Problems:

Finalized Frames are NOT skipped in Cumulated Result.

P1) The cumulated result (Hdcp Score) of the results of professional Bowling Scorer Web-Application differs to the my solution.

REASON: The finalized results are skipped in calculating the total sum.

Screenshots

World Bowling SCORER

reset restart player++ Fault 0 1 2 3 4 5 6 7 8 9 10

Player	0	1	2	3	4	5	6	7	8	9	10	Total
Player 0	30	59	79	99	109							109
Player 2	30	59	79	96	105							105
Player 3	16	29	41	51	61							61

Bowling Score Calculator

bowlinggenius.com

10 Pin Calculator Other Games

About

Bowling Genius

Click Number of Pins Knocked Down

0 1 2 3 4 5 6 7 8 9 10

Add Another Game

1	2	3	4	5	6	7	8	9	10	Hdcp Score	Max possible
X	X	X	9 /	X						99	279
30	59	79	99								

1	2	3	4	5	6	7	8	9	10	Hdcp Score	Max possible
X	X	X	9 /	7 2						105	255
30	59	79	96	105							

1	2	3	4	5	6	7	8	9	10	Hdcp Score	Max possible
1 /	6 /	3 /	2 /	0 /						51	221
16	29	41	51								

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Version 2.10

PRIVACY policy

Revalidation

FIXED: FAULTY calculation of intermediate results:

A problem occurred during validation has been fixed and revalidated

The finalized results ARE NOW SKIPPED in calculating the total sum as given in the web bowling-scorer at www.bowlinggenius.com.

World Bowling SCORER											
reset restart player++			Fault 0 1 2 3 4 5 6 7 8 9 10								
Player 0	X	X	X	9 /	X						
	30	59	79	99							99
Player 2	X	X	X	9 /	7 2						
	30	59	79	96	105						105
Player 3	1 /	6 /	3 /	2 /	- /						
	16	29	41	51							51

Revalidating <http://slocums.homestead.com>

Some extra tests have been performed in revalidation.

See: <http://slocums.homestead.com/gamescore.html>

1	2	3	4	5	6	7	8	9	10
X	7 /	9 -	X	- 8	⑧ /	F 6	X	X	8 1
20	39	48	66	74	84	90	120	148	167

1	2	3	4	5	6	7	8	9	10
X	7 /	9 -	X	- 8	⑧ /	F 6	X	X	7 2
20	39	48	66	74	84	90	117	136	145

World Bowling SCORER											
reset restart player++											
Player 0	X	7 /	9 -	X	- 8	8 /	F 6	X	X	X 8 1	
	20	39	48	66	74	84	90	120	148	167	167
Player 1	X	7 /	9 -	X	- 8	8 /	F 6	X	X	7 2	
	20	39	48	66	74	84	90	117	136	145	145