tAltris

v1.0

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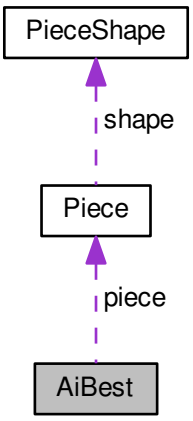
Chapter 3

Data Structure Documentation

3.1 AiBest Struct Reference

`#include <engine.h>`

Collaboration diagram for AiBest:



Data Fields

- **Piece** * **piece**
- double **score**

3.1.1 Field Documentation

3.1.1.1 piece

```
Piece* piece
```

3.1.1.2 score

```
double score
```

The documentation for this struct was generated from the following file:

- src/ai/genetic/ **engine.h**

3.2 AiCoefs Struct Reference

```
#include <engine.h>
```

Data Fields

- double **agg_height**
- double **holes**
- double **clears**
- double **bumpiness**

3.2.1 Field Documentation

3.2.1.1 agg_height

```
double agg_height
```

3.2.1.2 bumpiness

```
double bumpiness
```

3.2.1.3 clears

```
double clears
```

3.2.1.4 holes

```
double holes
```

The documentation for this struct was generated from the following file:

- src/ai/genetic/ **engine.h**

3.3 Board Struct Reference

```
#include <board.h>
```

Data Fields

- int **width**
- int **height**
- **Cell** * **cells**

3.3.1 Field Documentation

3.3.1.1 cells

```
Cell* cells
```

3.3.1.2 height

```
int height
```

3.3.1.3 width

```
int width
```

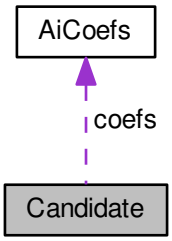
The documentation for this struct was generated from the following file:

- src/engine/ **board.h**

3.4 Candidate Struct Reference

```
#include <candidate.h>
```

Collaboration diagram for Candidate:



Data Fields

- **AiCoefs** * **coefs**
- double **fitness**

3.4.1 Field Documentation

3.4.1.1 coefs

```
AiCoefs* coefs
```

3.4.1.2 fitness

```
double fitness
```

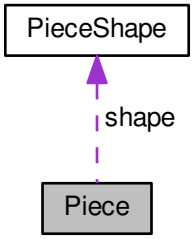
The documentation for this struct was generated from the following file:

- src/ai/genetic/ **candidate.h**

3.5 Piece Struct Reference

```
#include <piece.h>
```

Collaboration diagram for Piece:



Data Fields

- **PieceType type**
- const **PieceShape** * **shape**
- int **x**
- int **y**
- **Angle angle**

3.5.1 Field Documentation

3.5.1.1 angle

```
Angle angle
```

3.5.1.2 shape

```
const PieceShape* shape
```

3.5.1.3 type

```
PieceType type
```

3.5.1.4 x

```
int x
```

3.5.1.5 y

```
int y
```

The documentation for this struct was generated from the following file:

- src/engine/piece/ **piece.h**

3.6 PieceQueue Struct Reference

```
#include <piece_queue.h>
```

Data Fields

- unsigned int **seed**
- size_t **length**
- **PieceType** * **data**

3.6.1 Field Documentation

3.6.1.1 data

```
PieceType* data
```

3.6.1.2 length

```
size_t length
```

3.6.1.3 seed

```
unsigned int seed
```

The documentation for this struct was generated from the following file:

- src/engine/piece/ **piece_queue.h**

3.7 PieceShape Struct Reference

```
#include <piece_shape.h>
```

Data Fields

- int **shape** [**ANGLE_ESIZE**][**PIECE_SHAPE_HEIGHT**][**PIECE_SHAPE_WIDTH**]
- **Cell fill**

3.7.1 Field Documentation

3.7.1.1 fill

```
Cell fill
```

3.7.1.2 shape

```
int shape[ ANGLE_ESIZE][ PIECE_SHAPE_HEIGHT][ PIECE_SHAPE_WIDTH]
```

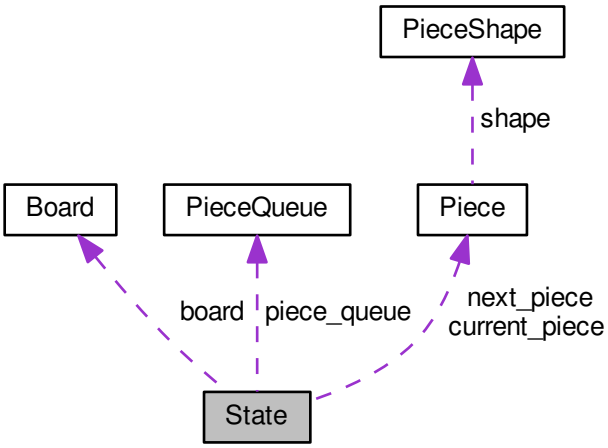
The documentation for this struct was generated from the following file:

- src/engine/piece/ **piece_shape.h**

3.8 State Struct Reference

`#include <state.h>`

Collaboration diagram for State:



Data Fields

- unsigned int **score**
- unsigned int **level**
- unsigned int **broken_lines**
- unsigned int **step**
- unsigned int **input_counts**
- **Board** * **board**
- **PieceQueue** * **piece_queue**
- size_t **piece_queue_index**
- **Piece** * **current_piece**
- **Piece** * **next_piece**

3.8.1 Field Documentation

3.8.1.1 board

Board* board

3.8.1.2 broken_lines

```
unsigned int broken_lines
```

3.8.1.3 current_piece

```
Piece* current_piece
```

3.8.1.4 input_counts

```
unsigned int input_counts
```

3.8.1.5 level

```
unsigned int level
```

3.8.1.6 next_piece

```
Piece* next_piece
```

3.8.1.7 piece_queue

```
PieceQueue* piece_queue
```

3.8.1.8 piece_queue_index

```
size_t piece_queue_index
```

3.8.1.9 score

```
unsigned int score
```

3.8.1.10 step

```
unsigned int step
```

The documentation for this struct was generated from the following file:

- src/engine/ **state.h**

Chapter 4

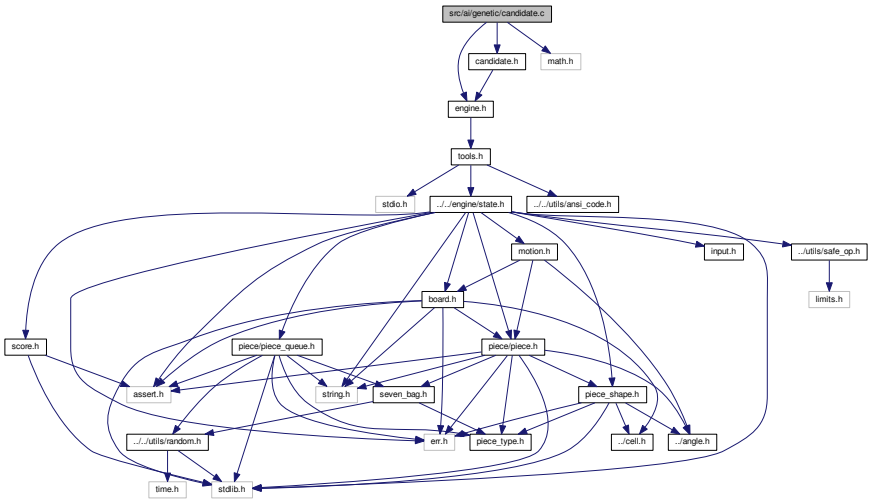
File Documentation

4.1 src/ai/genetic/candidate.c File Reference

No description.

```
#include "candidate.h"
#include "math.h"
#include "engine.h"
```

Include dependency graph for candidate.c:



Functions

- **Candidate** ∗ **genetic_candidate_create_random** ()
- **Candidate** ∗ **genetic_candidate_create** ()
- void **genetic_candidate_free** (**Candidate** ∗candidate)
- void **genetic_candidate_normalize** (**Candidate** ∗candidate)
- **Candidate** ∗ **genetic_candidate_crossover** (**Candidate** ∗cdt1, **Candidate** ∗cdt2)
- void **genetic_candidate_mutate** (**Candidate** ∗cdt)

4.1.1 Detailed Description

No description.

Author

S4MasterRace

Version

2.0

4.1.2 Function Documentation

4.1.2.1 genetic_candidate_create()

```
Candidate* genetic_candidate_create ( )
```

4.1.2.2 genetic_candidate_create_random()

```
Candidate* genetic_candidate_create_random ( )
```

4.1.2.3 genetic_candidate_crossover()

```
Candidate* genetic_candidate_crossover (
              Candidate * cdt1,
              Candidate * cdt2 )
```

4.1.2.4 genetic_candidate_free()

```
void genetic_candidate_free (
              Candidate * candidate )
```

4.1.2.5 genetic_candidate_mutate()

```
void genetic_candidate_mutate (
              Candidate * cdt )
```

4.1.2.6 genetic_candidate_normalize()

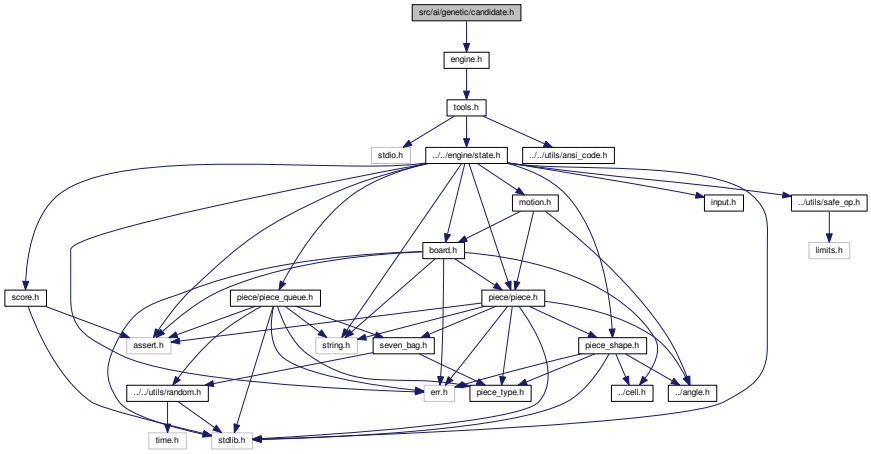
```
void genetic_candidate_normalize (
            Candidate * candidate )
```

4.2 src/ai/genetic/candidate.h File Reference

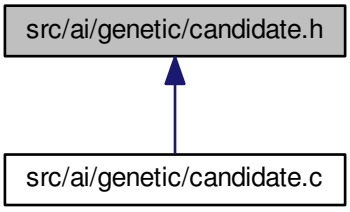
No description.

```
#include "engine.h"
```

Include dependency graph for candidate.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct **Candidate**

Functions

- **Candidate** * **genetic_candidate_create** ()
- void **genetic_candidate_free** (**Candidate** *candidate)
- void **genetic_candidate_normalize** (**Candidate** *candidate)
- **Candidate** * **genetic_candidate_crossover** (**Candidate** *cdt1, **Candidate** *cdt2)
- void **genetic_candidate_mutate** (**Candidate** *cdt)

4.2.1 Detailed Description

No description.

Author

S4MasterRace

Version

2.0

4.2.2 Function Documentation

4.2.2.1 genetic_candidate_create()

```
Candidate* genetic_candidate_create ( )
```

4.2.2.2 genetic_candidate_crossover()

```
Candidate* genetic_candidate_crossover (
            Candidate * cdt1,
            Candidate * cdt2 )
```

4.2.2.3 genetic_candidate_free()

```
void genetic_candidate_free (
            Candidate * candidate )
```

4.2.2.4 genetic_candidate_mutate()

```
void genetic_candidate_mutate (
            Candidate * cdt )
```

4.2.2.5 genetic_candidate_normalize()

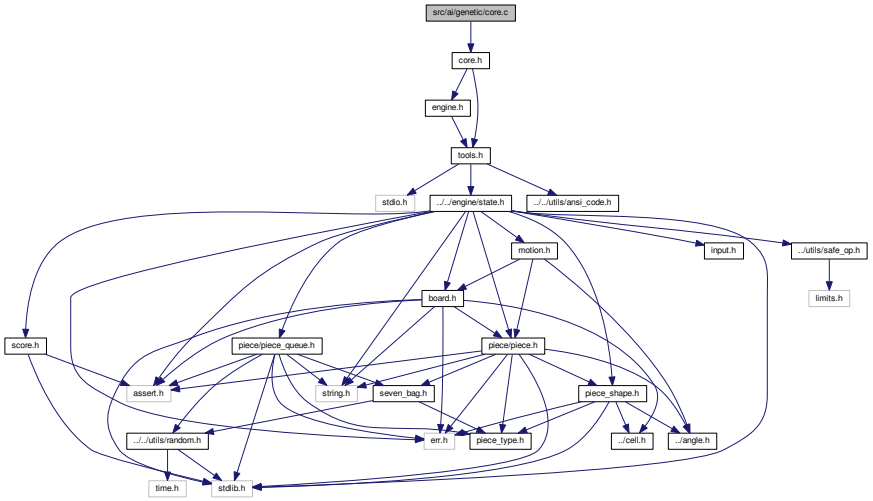
```
void genetic_candidate_normalize (
            Candidate * candidate )
```

4.3 src/ai/genetic/core.c File Reference

Core of the genetic algorithm.

```
#include "core.h"
```

Include dependency graph for core.c:



Functions

- void **genetic_show_stats** (**State** *state)

4.3.1 Detailed Description

Core of the genetic algorithm.

Author

S4MasterRace

Version

2.0

4.3.2 Function Documentation

4.3.2.1 genetic_show_stats()

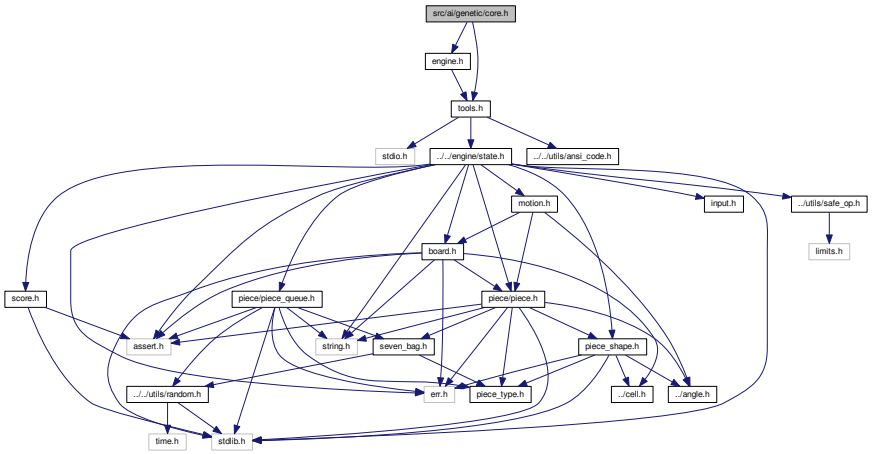
```
void genetic_show_stats (
              State * state )
```

4.4 src/ai/genetic/core.h File Reference

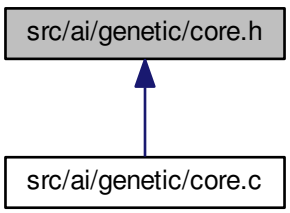
Core of the genetic algorithm.

```
#include "engine.h"
#include "tools.h"
```

Include dependency graph for core.h:



This graph shows which files directly or indirectly include this file:



Functions

- void **genetic_show_stats** (**State** *state)

4.4.1 Detailed Description

Core of the genetic algorithm.

Author

S4MasterRace

Version

2.0

4.4.2 Function Documentation

4.4.2.1 genetic_show_stats()

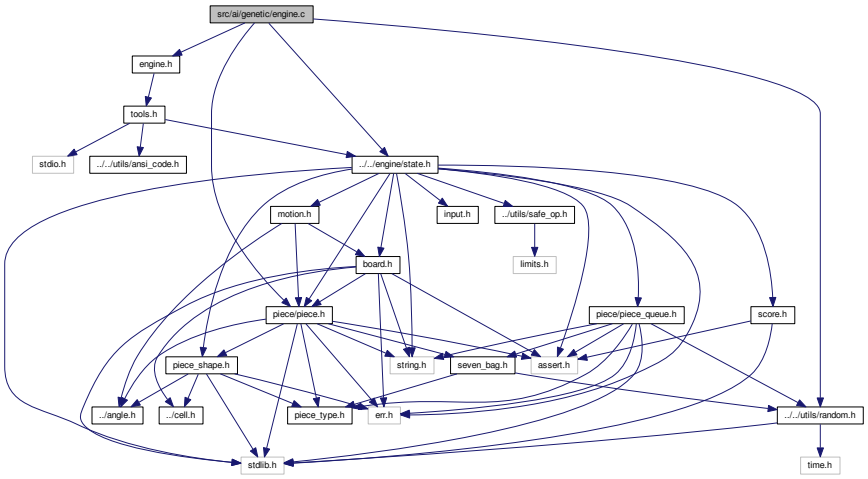
```
void genetic_show_stats (
            State * state )
```

4.5 src/ai/genetic/engine.c File Reference

Engine for the genetic algorithm.

```
#include "engine.h"
#include "../../utils/random.h"
#include "../../engine/state.h"
#include "../../engine/piece/piece.h"
```

Include dependency graph for engine.c:



Functions

- double **genetic_get_rank** (**State** ∗state)
- **AiCoefs** ∗ **genetic_coefs_get** ()
- **AiCoefs** ∗ **genetic_aicoefs_random** ()
- void **genetic_aicoefs_free** (**AiCoefs** ∗coefs)
- **AiBest** ∗ **genetic_aibest_create** (**Piece** ∗p, double s)
- void **genetic_aibest_free** (**AiBest** ∗ab)
- **AiBest** ∗ **_genetic_best** (**State** ∗state, int workingPieceIdx)
- **Piece** ∗ **genetic_best** (**State** ∗state)

4.5.1 Detailed Description

Engine for the genetic algorithm.

Author

S4MasterRace

Version

2.0

4.5.2 Function Documentation

4.5.2.1 _genetic_best()

```
AiBest* _genetic_best (
            State * state,
           int workingPieceIdx )
```

4.5.2.2 genetic_aibest_create()

```
AiBest* genetic_aibest_create (
            Piece * p,
           double s )
```

4.5.2.3 genetic_aibest_free()

```
void genetic_aibest_free (
            AiBest * ab )
```

4.5.2.4 genetic_aicoefs_free()

```
void genetic_aicoefs_free (
              AiCoefs * coefs )
```

4.5.2.5 genetic_aicoefs_random()

```
AiCoefs* genetic_aicoefs_random ( )
```

4.5.2.6 genetic_best()

```
Piece* genetic_best (
              State * state )
```

4.5.2.7 genetic_coefs_get()

```
AiCoefs* genetic_coefs_get ( )
```

4.5.2.8 genetic_get_rank()

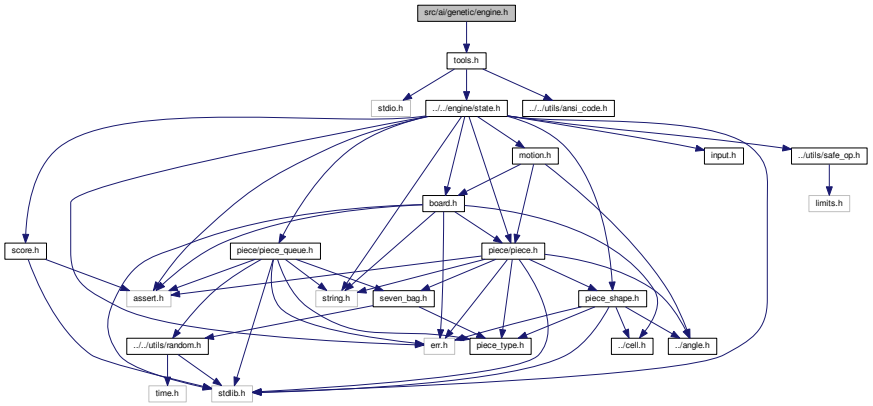
```
double genetic_get_rank (
              State * state )
```

4.6 src/ai/genetic/engine.h File Reference

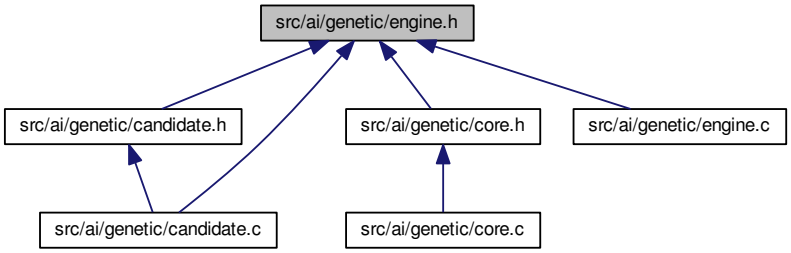
Engine for the genetic algorithm.

```
#include "tools.h"
```

Include dependency graph for engine.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct **AiBest**
- struct **AiCoefs**

Functions

- double **genetic_get_rank** (**State** *state)
- **AiCoefs** * **genetic_coefs_get** ()
- **AiCoefs** * **genetic_aicoefs_random** ()
- void **genetic_aicoefs_free** (**AiCoefs** *coefs)
- **AiBest** * **genetic_aibest_create** (**Piece** *p, double s)
- void **genetic_aibest_free** (**AiBest** *ab)

4.6.1 Detailed Description

Engine for the genetic algorithm.

Author

S4MasterRace

Version

2.0

4.6.2 Function Documentation

4.6.2.1 genetic_aibest_create()

```
AiBest* genetic_aibest_create (
            Piece * p,
           double s )
```

4.6.2.2 genetic_aibest_free()

```
void genetic_aibest_free (
            AiBest * ab )
```

4.6.2.3 genetic_aicoefs_free()

```
void genetic_aicoefs_free (
            AiCoefs * coefs )
```

4.6.2.4 genetic_aicoefs_random()

```
AiCoefs* genetic_aicoefs_random ( )
```

4.6.2.5 genetic_coefs_get()

```
AiCoefs* genetic_coefs_get ( )
```

4.6.2.6 genetic_get_rank()

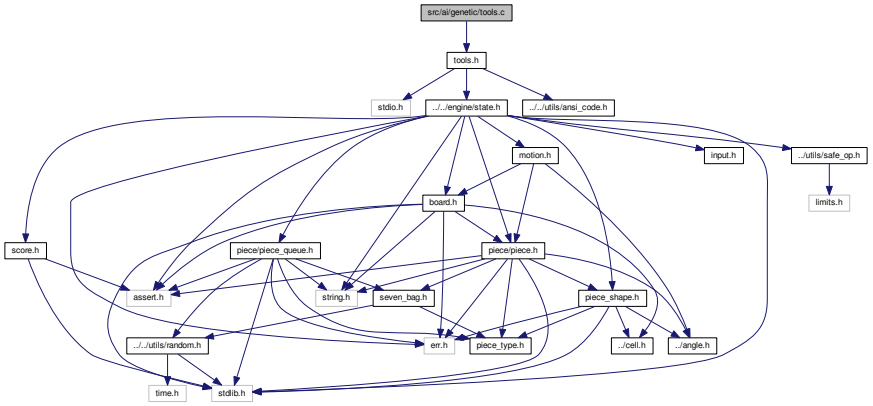
```
double genetic_get_rank (
            State * state )
```

4.7 src/ai/genetic/tools.c File Reference

Tools for the genetic algorithm.

```
#include "tools.h"
```

Include dependency graph for tools.c:



Functions

- void **board_heights** (const **Board** *brd, int *heights)
- int **board_height** (const **Board** *brd, int x)
- int **bumpiness** (const **Board** *brd)
- int **aggregate_height** (const **Board** *brd)
- int **hole** (const **Board** *brd, int x)
- int **holes** (const **Board** *brd)
- int **clears** (const **Board** *brd)
- void **show_features** (const **Board** *brd)

4.7.1 Detailed Description

Tools for the genetic algorithm.

Author

S4MasterRace

Version

2.0

4.7.2 Function Documentation

4.7.2.1 aggregate_height()

```
int aggregate_height (
            const  Board * brd )
```

4.7.2.2 board_height()

```
int board_height (
            const  Board * brd,
            int x )
```

4.7.2.3 board_heights()

```
void board_heights (
            const  Board * brd,
            int * heights )
```

4.7.2.4 bumpiness()

```
int bumpiness (
            const  Board * brd )
```

4.7.2.5 clears()

```
int clears (
            const  Board * brd )
```

4.7.2.6 hole()

```
int hole (
            const  Board * brd,
            int x )
```

4.7.2.7 holes()

```
int holes (
            const  Board * brd )
```

4.7.2.8 show_features()

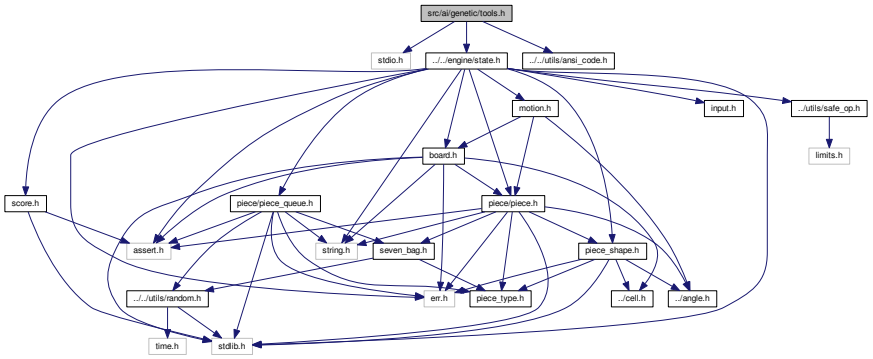
```
void show_features (
            const  Board * brd )
```

4.8 src/ai/genetic/tools.h File Reference

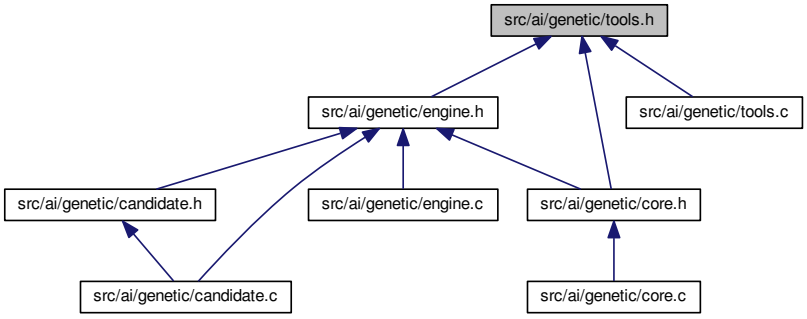
Tools for the genetic algorithm.

```
#include <stdio.h>
#include "../../engine/state.h"
#include "../../utils/ansi_code.h"
```

Include dependency graph for tools.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define **ABS**(X) (((X) < 0) ? (-1 * (X)) : (X))

Functions

- int **board_height** (const **Board** *brd, int x)
- void **board_heights** (const **Board** *brd, int *heights)
- int **bumpiness** (const **Board** *brd)
- int **aggregate_height** (const **Board** *brd)
- int **hole** (const **Board** *brd, int x)
- int **holes** (const **Board** *brd)
- size_t **coalescent_clears** (const **Board** *brd)
- int **clears** (const **Board** *brd)
- void **show_features** (const **Board** *brd)

4.8.1 Detailed Description

Tools for the genetic algorithm.

Author

S4MasterRace

Version

2.0

4.8.2 Macro Definition Documentation

4.8.2.1 ABS

```
#define ABS(
              X ) (((X) < 0) ?  (-1 * (X)) : (X))
```

4.8.3 Function Documentation

4.8.3.1 aggregate_height()

```
int aggregate_height (
             const  Board * brd )
```

4.8.3.2 board_height()

```
int board_height (
            const  Board * brd,
            int x )
```

4.8.3.3 board_heights()

```
void board_heights (
            const  Board * brd,
            int * heights )
```

4.8.3.4 bumpiness()

```
int bumpiness (
            const  Board * brd )
```

4.8.3.5 clears()

```
int clears (
            const  Board * brd )
```

4.8.3.6 coalescent_clears()

```
size_t coalescent_clears (
            const  Board * brd )
```

4.8.3.7 hole()

```
int hole (
            const  Board * brd,
            int x )
```

4.8.3.8 holes()

```
int holes (
            const  Board * brd )
```

4.8.3.9 show_features()

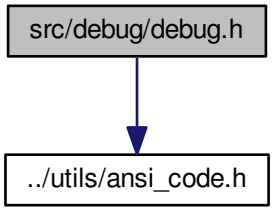
```
void show_features (
            const  Board * brd )
```

4.9 src/debug/debug.h File Reference

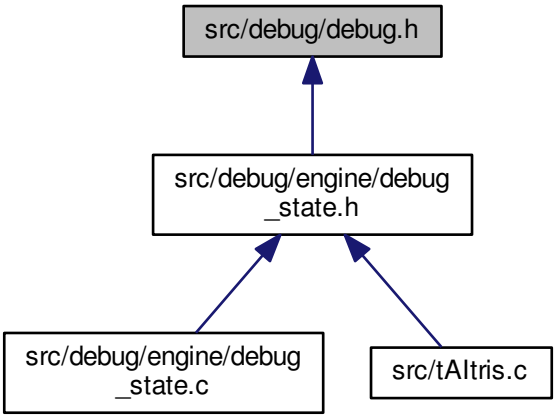
Debug.

```
#include "../utils/ansi_code.h"
```

Include dependency graph for debug.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define **DEBUG_TAG**(_name_, _color_)

4.9.1 Detailed Description

Debug.

Author

S4MasterRace

Version

2.0

4.9.2 Macro Definition Documentation

4.9.2.1 DEBUG_TAG

```
#define DEBUG_TAG(
              _name_,
              _color_ )
```

Value:

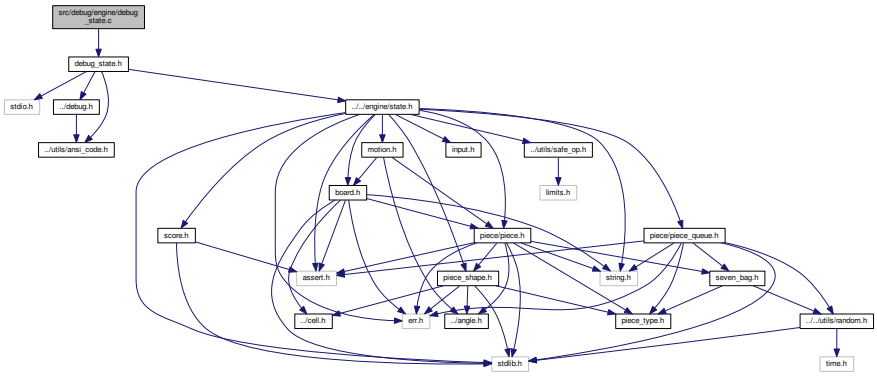
```
ANSI_RESET \
  "[" ANSI_FG_CYAN "Debug" ANSI_RESET "]" \
  "(" _color_ _name_ ANSI_RESET ") "
```

4.10 src/debug/engine/debug_state.c File Reference

Debug state.

```
#include "debug_state.h"
```

Include dependency graph for debug_state.c:



Functions

- void **debug_state_print_line_number** (const **Board** *brd, int y)
- void **debug_state_print_cell** (**Cell** c)
- void **debug_state_print_infos** (const **State** *state, int y)
- void **debug_state_print_next_piece** (const **Piece** *pc, int y)
- void **debug_state_print** (const **State** *state)

4.10.1 Detailed Description

Debug state.

Author

S4MasterRace

Version

2.0

4.10.2 Function Documentation

4.10.2.1 debug_state_print()

```
void debug_state_print (
            const  State * state )
```

4.10.2.2 debug_state_print_cell()

```
void debug_state_print_cell (
             Cell c )
```

4.10.2.3 debug_state_print_infos()

```
void debug_state_print_infos (
            const  State * state,
            int y )
```

4.10.2.4 debug_state_print_line_number()

```
void debug_state_print_line_number (
            const  Board * brd,
            int y )
```

4.10.2.5 debug_state_print_next_piece()

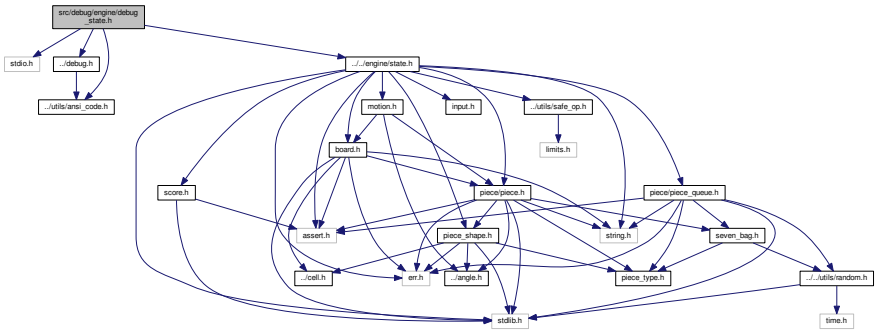
```
void debug_state_print_next_piece (
            const  Piece * pc,
            int y )
```

4.11 src/debug/engine/debug_state.h File Reference

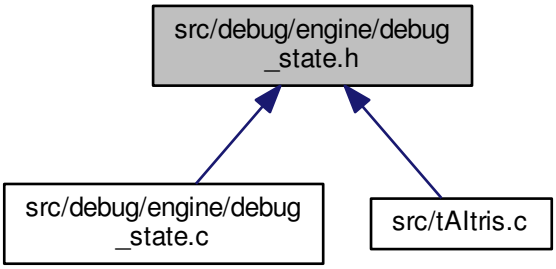
Debug state.

```
#include <stdio.h>
#include "../debug.h"
#include "../../engine/state.h"
#include "../../utils/ansi_code.h"
```

Include dependency graph for debug_state.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define **DEBUG_STATE_NAME** "State"
- #define **DEBUG_STATE_COLOR** **ANSI_FG_MAGENTA**
- #define **DEBUG_STATE_TAG** **DEBUG_TAG**(**DEBUG_STATE_NAME**, **DEBUG_STATE_COLOR**)

Functions

- void **debug_state_print_line_number** (const **Board** *brd, int y)
- void **debug_state_print_cell** (**Cell** c)
- void **debug_state_print_infos** (const **State** *state, int y)
- void **debug_state_print_next_piece** (const **Piece** *pc, int y)
- void **debug_state_print** (const **State** *state)

4.11.1 Detailed Description

Debug state.

Author

S4MasterRace

Version

2.0

4.11.2 Macro Definition Documentation

4.11.2.1 DEBUG_STATE_COLOR

```
#define DEBUG_STATE_COLOR  ANSI_FG_MAGENTA
```

4.11.2.2 DEBUG_STATE_NAME

```
#define DEBUG_STATE_NAME "State"
```

4.11.2.3 DEBUG_STATE_TAG

```
#define DEBUG_STATE_TAG  DEBUG_TAG( DEBUG_STATE_NAME,  DEBUG_STATE_COLOR)
```

4.11.3 Function Documentation

4.11.3.1 debug_state_print()

```
void debug_state_print (
            const  State * state )
```

4.11.3.2 debug_state_print_cell()

```
void debug_state_print_cell (
             Cell c )
```

4.11.3.3 debug_state_print_infos()

```
void debug_state_print_infos (
            const  State * state,
            int y )
```

4.11.3.4 debug_state_print_line_number()

```
void debug_state_print_line_number (
            const  Board * brd,
            int y )
```

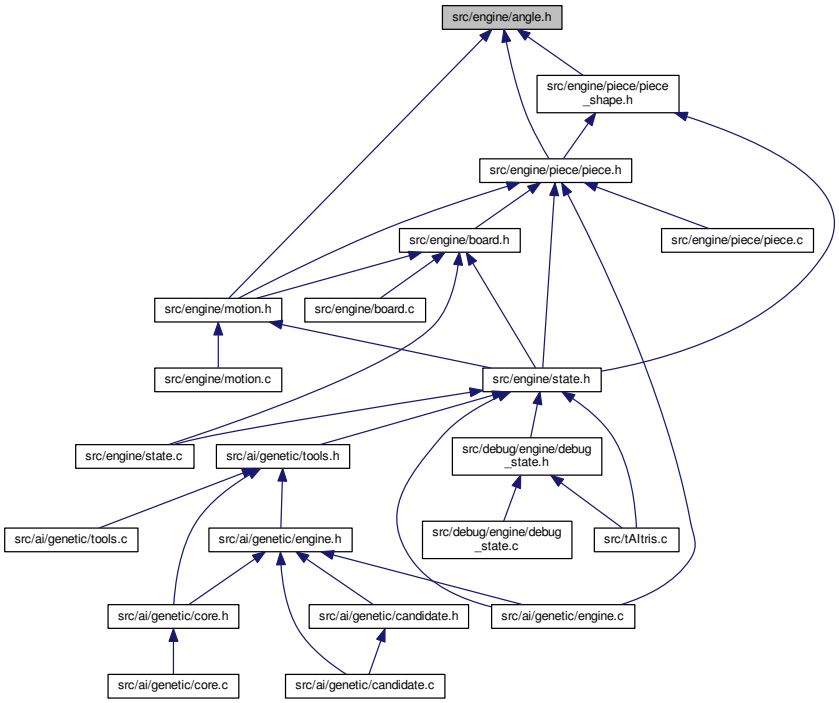
4.11.3.5 debug_state_print_next_piece()

```
void debug_state_print_next_piece (
            const  Piece * pc,
            int y )
```

4.12 src/engine/angle.h File Reference

Angle.

This graph shows which files directly or indirectly include this file:



Macros

- #define **ANGLE_ESIZE** 4

Enumerations

- enum **Angle** { **ANGLE_UP**, **ANGLE_RIGHT**, **ANGLE_DOWN**, **ANGLE_LEFT** }
- enum **Rotation** { **ROTATE_LEFT** = -1, **ROTATE_RIGHT** = 1 }

4.12.1 Detailed Description

Angle.

Author

S4MasterRace

Version

2.0

4.12.2 Macro Definition Documentation

4.12.2.1 ANGLE_ESIZE

```
#define ANGLE_ESIZE 4
```

4.12.3 Enumeration Type Documentation

4.12.3.1 Angle

enum **Angle**

Enumerator

ANGLE_UP	
ANGLE_RIGHT	
ANGLE_DOWN	
ANGLE_LEFT	

4.12.3.2 Rotation

enum **Rotation**

Enumerator

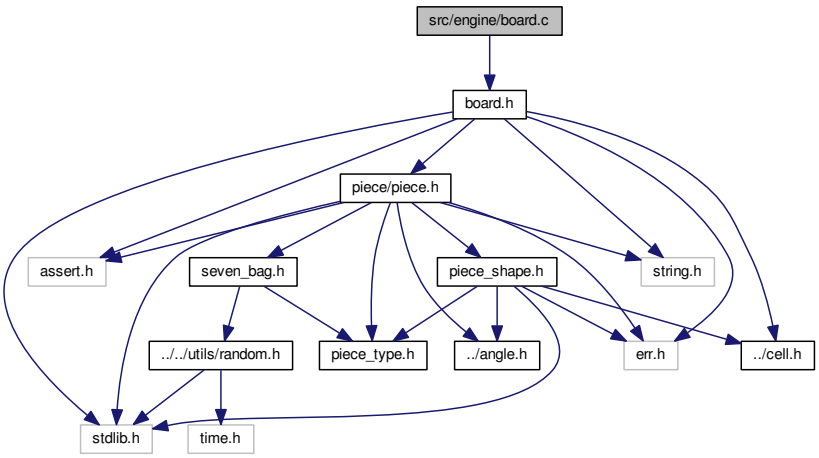
ROTATE_LEFT	
ROTATE_RIGHT	

4.13 src/engine/board.c File Reference

Board (p. 7).

```
#include "board.h"
```

Include dependency graph for board.c:



Functions

- **Board** ∗ **board_create** (int width, int height)
- void **board_init** (**Board** ∗brd)
- void **board_free** (**Board** ∗brd)
- **Board** ∗ **board_copy** (**Board** ∗brd)
- size_t **board_get_completed_lines** (const **Board** ∗brd, int ∗hist)
- void **board_break_lines** (**Board** ∗brd, const int ∗hist)
- int **board_merge_piece** (**Board** ∗brd, const **Piece** ∗pc)

4.13.1 Detailed Description

Board (p. 7).

Author

S4MasterRace

Version

2.0

4.13.2 Function Documentation

4.13.2.1 board_break_lines()

```
void board_break_lines (
              Board * brd,
             const int * hist )
```

4.13.2.2 board_copy()

```
Board* board_copy (
              Board * brd )
```

4.13.2.3 board_create()

```
Board* board_create (
             int width,
             int height )
```

4.13.2.4 board_free()

```
void board_free (
              Board * brd )
```

4.13.2.5 board_get_completed_lines()

```
size_t board_get_completed_lines (
             const  Board * brd,
             int * hist )
```

4.13.2.6 board_init()

```
void board_init (
              Board * brd )
```

4.13.2.7 board_merge_piece()

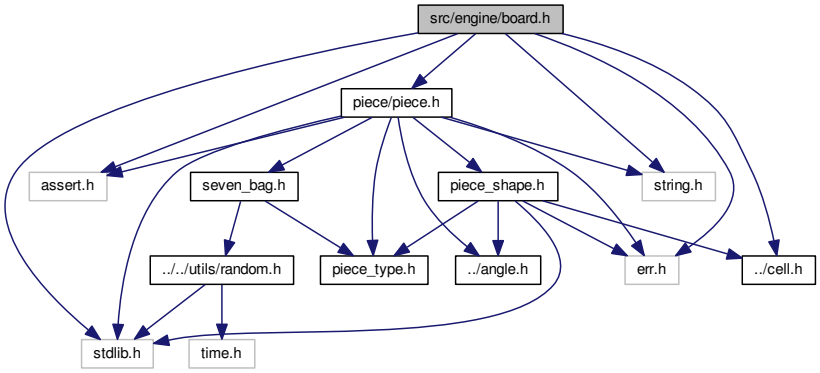
```
int board_merge_piece (
            Board * brd,
            const  Piece * pc )
```

4.14 src/engine/board.h File Reference

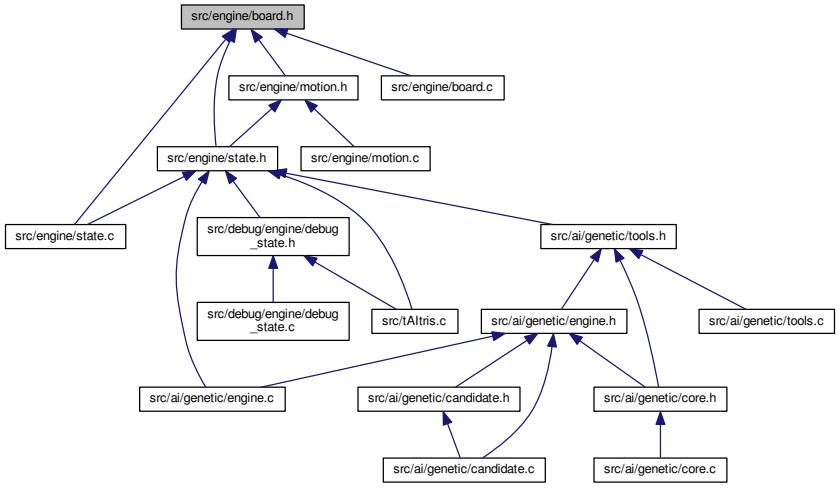
Board (p. 7).

```
#include <stdlib.h>
#include <assert.h>
#include <string.h>
#include <err.h>
#include "piece/piece.h"
#include "cell.h"
```

Include dependency graph for board.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct **Board**

Macros

- #define **BOARD_WIDTH** 10
- #define **BOARD_HEIGHT** 20
- #define **BOARD_HIDDEN** 2
- #define **board_reverse_y**(_brd_, _y_) ((_brd_)->height - 1 - (_y_))

Functions

- **Board** * **board_create** (int width, int height)
- void **board_init** (**Board** *brd)
- void **board_free** (**Board** *brd)
- **Board** * **board_copy** (**Board** *brd)
- size_t **board_get_completed_lines** (const **Board** *brd, int *hist)
- void **board_break_lines** (**Board** *brd, const int *hist)
- int **board_merge_piece** (**Board** *brd, const **Piece** *pc)

4.14.1 Detailed Description

Board (p. 7).

Author

S4MasterRace

Version

2.0

4.14.2 Macro Definition Documentation

4.14.2.1 BOARD_HEIGHT

```
#define BOARD_HEIGHT 20
```

4.14.2.2 BOARD_HIDDEN

```
#define BOARD_HIDDEN 2
```

4.14.2.3 board_reverse_y

```
#define board_reverse_y(
              _brd_,
              _y_ ) ((_brd_)->height - 1 - (_y_))
```

4.14.2.4 BOARD_WIDTH

```
#define BOARD_WIDTH 10
```

4.14.3 Function Documentation

4.14.3.1 board_break_lines()

```
void board_break_lines (
              Board * brd,
             const int * hist )
```

4.14.3.2 board_copy()

```
Board* board_copy (
              Board * brd )
```

4.14.3.3 board_create()

```
Board* board_create (
             int width,
             int height )
```

4.14.3.4 board_free()

```
void board_free (
              Board * brd )
```

4.14.3.5 board_get_completed_lines()

```
size_t board_get_completed_lines (
            const  Board * brd,
            int * hist )
```

4.14.3.6 board_init()

```
void board_init (
             Board * brd )
```

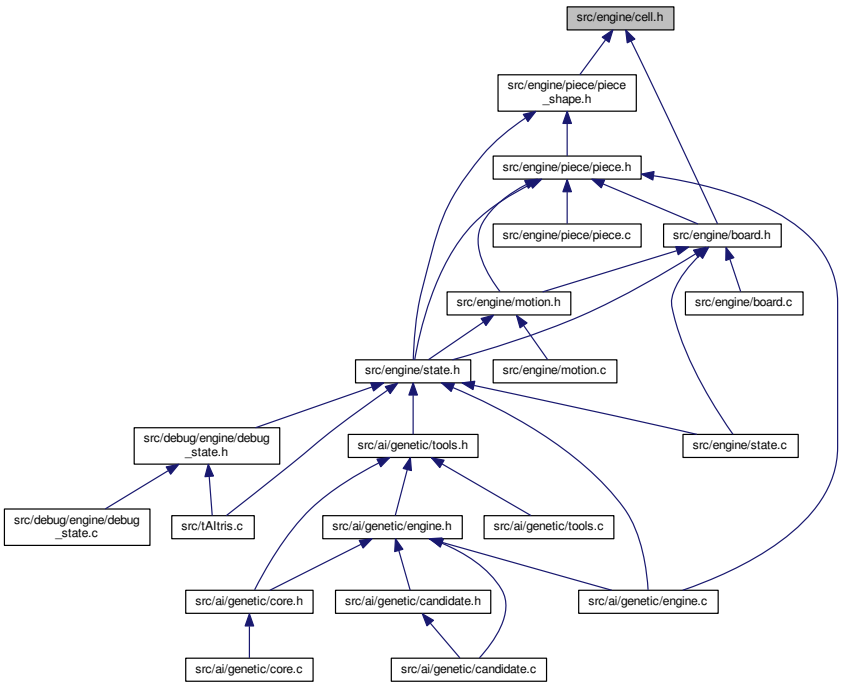
4.14.3.7 board_merge_piece()

```
int board_merge_piece (
             Board * brd,
            const  Piece * pc )
```

4.15 src/engine/cell.h File Reference

Cell.

This graph shows which files directly or indirectly include this file:



Macros

- #define **CELL_ESIZE** 8

Enumerations

- enum **Cell** {
  CELL_EMPTY, **CELL_CYAN**, **CELL_YELLOW**, **CELL_PURPLE**,
  CELL_GREEN, **CELL_RED**, **CELL_BLUE**, **CELL_ORANGE** }

4.15.1 Detailed Description

Cell.

Author

S4MasterRace

Version

2.0

4.15.2 Macro Definition Documentation

4.15.2.1 CELL_ESIZE

```
#define CELL_ESIZE 8
```

4.15.3 Enumeration Type Documentation

4.15.3.1 Cell

```
enum Cell
```

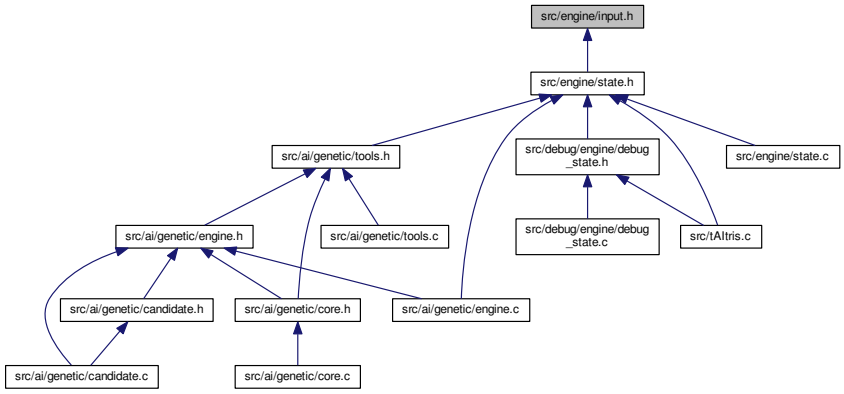
Enumerator

CELL_EMPTY	
CELL_CYAN	
CELL_YELLOW	
CELL_PURPLE	
CELL_GREEN	
CELL_RED	
CELL_BLUE	
CELL_ORANGE	

4.16 src/engine/input.h File Reference

Input.

This graph shows which files directly or indirectly include this file:



Macros

- #define **INPUT_ESIZE** 6

Enumerations

- enum **Input** {
  INPUT_MOVE_LEFT, **INPUT_MOVE_RIGHT**, **INPUT_ROTATE_RIGHT**, **INPUT_ROTATE_LEFT**,
  INPUT_SOFT_DROP, **INPUT_HARD_DROP** }

4.16.1 Detailed Description

Input.

Author

S4MasterRace

Version

2.0

4.16.2 Macro Definition Documentation

4.16.2.1 INPUT_ESIZE

```
#define INPUT_ESIZE 6
```

4.16.3 Enumeration Type Documentation

4.16.3.1 Input

```
enum Input
```

Enumerator

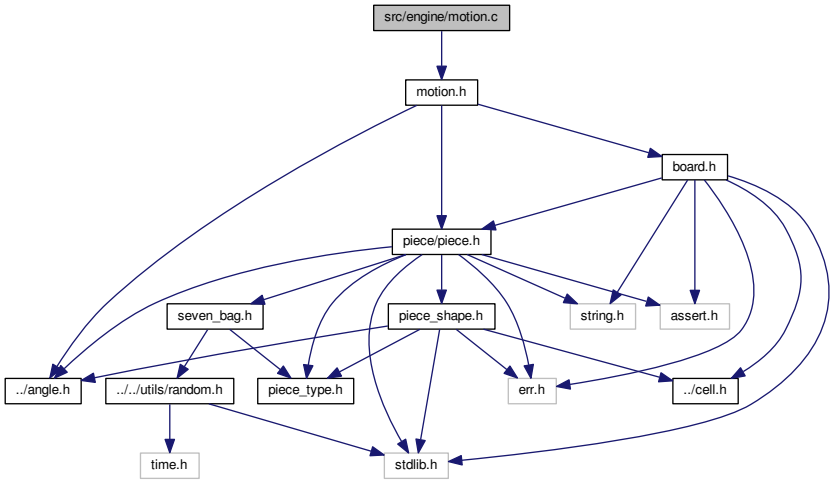
INPUT_MOVE_LEFT	
INPUT_MOVE_RIGHT	
INPUT_ROTATE_RIGHT	
INPUT_ROTATE_LEFT	
INPUT_SOFT_DROP	
INPUT_HARD_DROP	

4.17 src/engine/motion.c File Reference

Motion.

```
#include "motion.h"
```

Include dependency graph for motion.c:



Functions

- int **motion_is_valid** (const **Piece** *pc, const **Board** *brd)
- int **motion_try_move** (**Piece** *pc, const **Board** *brd, int dx, int dy)
- int **motion_try_down** (**Piece** *pc, const **Board** *brd)
- int **motion_try_rotate** (**Piece** *pc, const **Board** *brd, **Rotation** r)
- int **motion_can_move** (const **Piece** *pc, const **Board** *brd, int dx, int dy)
- int **motion_can_rotate** (const **Piece** *pc, const **Board** *brd, **Rotation** r)

4.17.1 Detailed Description

Motion.

Author

S4MasterRace

Version

2.0

4.17.2 Function Documentation

4.17.2.1 motion_can_move()

```
int motion_can_move (
            const  Piece * pc,
            const  Board * brd,
            int dx,
            int dy )
```

4.17.2.2 motion_can_rotate()

```
int motion_can_rotate (
            const  Piece * pc,
            const  Board * brd,
             Rotation r )
```

4.17.2.3 motion_is_valid()

```
int motion_is_valid (
            const  Piece * pc,
            const  Board * brd )
```

4.17.2.4 motion_try_down()

```
int motion_try_down (
              Piece * pc,
             const  Board * brd )
```

4.17.2.5 motion_try_move()

```
int motion_try_move (
              Piece * pc,
             const  Board * brd,
             int dx,
             int dy )
```

4.17.2.6 motion_try_rotate()

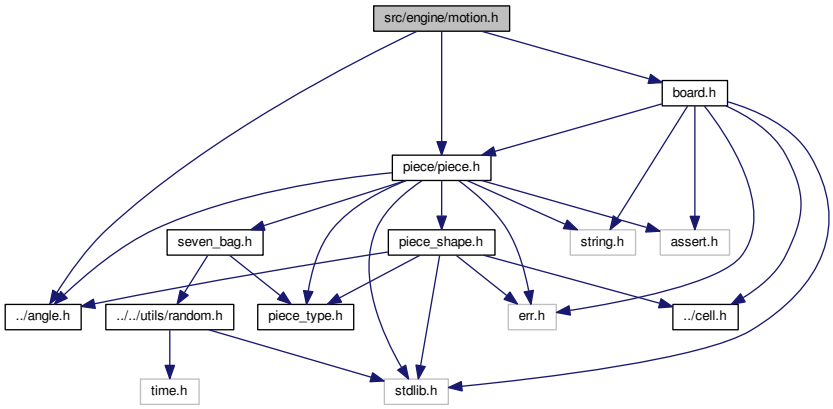
```
int motion_try_rotate (
              Piece * pc,
             const  Board * brd,
              Rotation r )
```

4.18 src/engine/motion.h File Reference

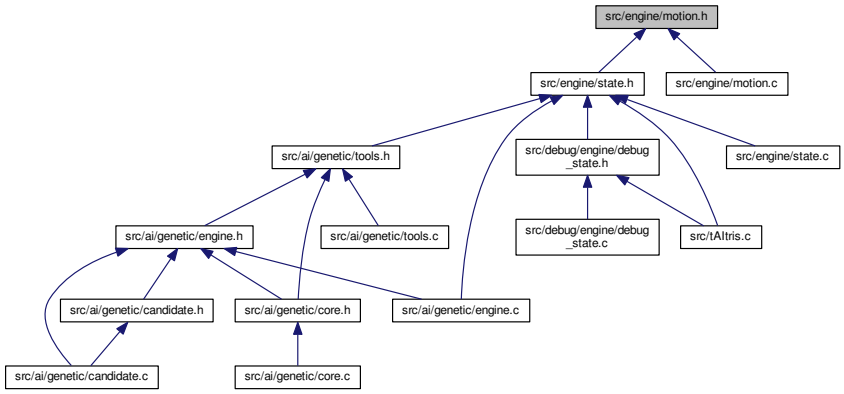
Motion.

```
#include "piece/piece.h"
#include "board.h"
#include "angle.h"
```

Include dependency graph for motion.h:



This graph shows which files directly or indirectly include this file:



Functions

- int **motion_is_valid** (const **Piece** *pc, const **Board** *brd)
- int **motion_try_move** (**Piece** *pc, const **Board** *brd, int dx, int dy)
- int **motion_try_rotate** (**Piece** *pc, const **Board** *brd, **Rotation** r)
- int **motion_try_down** (**Piece** *pc, const **Board** *brd)
- int **motion_can_move** (const **Piece** *pc, const **Board** *brd, int dx, int dy)
- int **motion_can_rotate** (const **Piece** *pc, const **Board** *brd, **Rotation** r)

4.18.1 Detailed Description

Motion.

Author

S4MasterRace

Version

2.0

4.18.2 Function Documentation

4.18.2.1 motion_can_move()

```
int motion_can_move (
            const  Piece * pc,
            const  Board * brd,
            int dx,
            int dy )
```

4.18.2.2 motion_can_rotate()

```
int motion_can_rotate (
            const  Piece * pc,
            const  Board * brd,
             Rotation r )
```

4.18.2.3 motion_is_valid()

```
int motion_is_valid (
            const  Piece * pc,
            const  Board * brd )
```

4.18.2.4 motion_try_down()

```
int motion_try_down (
             Piece * pc,
            const  Board * brd )
```

4.18.2.5 motion_try_move()

```
int motion_try_move (
             Piece * pc,
            const  Board * brd,
            int dx,
            int dy )
```

4.18.2.6 motion_try_rotate()

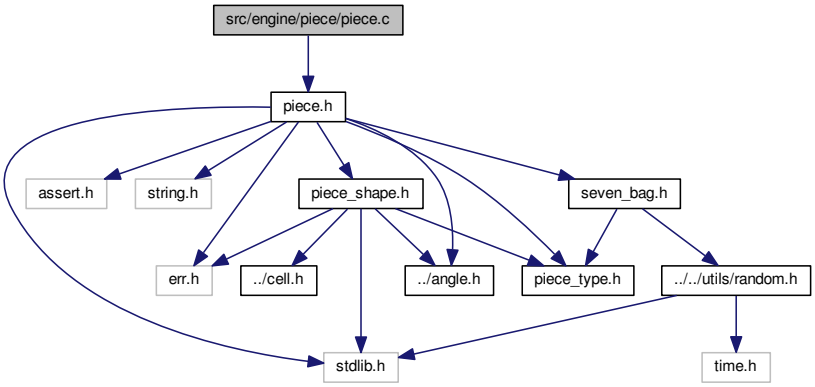
```
int motion_try_rotate (
             Piece * pc,
            const  Board * brd,
             Rotation r )
```

4.19 src/engine/piece/piece.c File Reference

Piece (p. 9).

```
#include "piece.h"
```

Include dependency graph for piece.c:



Functions

- **Piece** ∗ **piece_create** (**PieceType** type, int x, int y, **Angle** angle)
- void **piece_free** (**Piece** ∗pc)
- **Piece** ∗ **piece_copy** (const **Piece** ∗pc)
- **Piece** ∗ **piece_random** (int x, int y, **Angle** angle)

4.19.1 Detailed Description

Piece (p. 9).

Author

S4MasterRace

Version

2.0

4.19.2 Function Documentation

4.19.2.1 piece_copy()

```
Piece* piece_copy (
            const  Piece * pc )
```

4.19.2.2 piece_create()

```
Piece* piece_create (
             PieceType type,
            int x,
            int y,
             Angle angle )
```

4.19.2.3 piece_free()

```
void piece_free (
             Piece * pc )
```

4.19.2.4 piece_random()

```
Piece* piece_random (
            int x,
            int y,
             Angle angle )
```

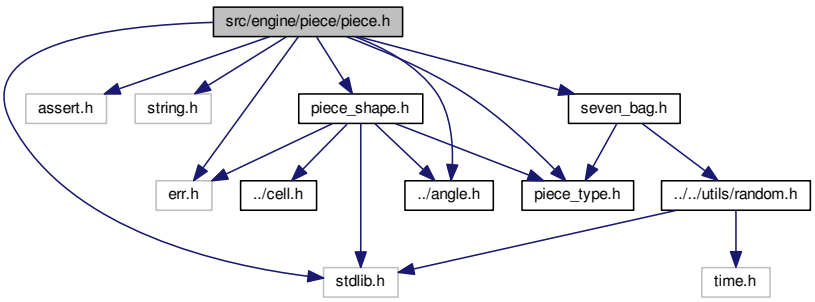
4.20 src/engine/piece/piece.h File Reference

Piece (p. 9).

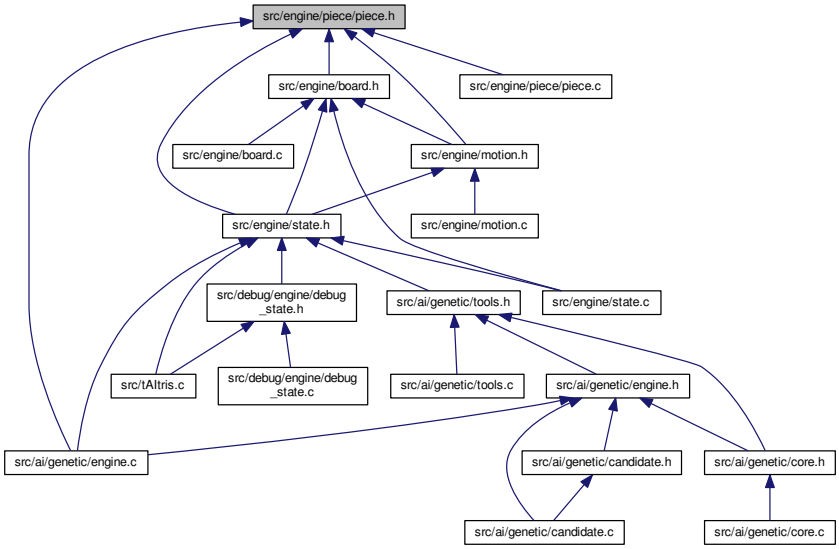
```
#include <stdlib.h>
#include <assert.h>
#include <string.h>
#include <err.h>
#include "piece_type.h"
#include "piece_shape.h"
#include "../angle.h"
```

```
#include "seven_bag.h"
```

Include dependency graph for piece.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct **Piece**

Functions

- **Piece** ∗ **piece_create** (**PieceType** type, int x, int y, **Angle** angle)
- void **piece_free** (**Piece** ∗pc)
- **Piece** ∗ **piece_copy** (const **Piece** ∗pc)
- **Piece** ∗ **piece_random** (int x, int y, **Angle** angle)

4.20.1 Detailed Description

Piece (p. 9).

Author

S4MasterRace

Version

2.0

4.20.2 Function Documentation

4.20.2.1 piece_copy()

```
Piece* piece_copy (
            const  Piece * pc )
```

4.20.2.2 piece_create()

```
Piece* piece_create (
             PieceType type,
            int x,
            int y,
             Angle angle )
```

4.20.2.3 piece_free()

```
void piece_free (
             Piece * pc )
```

4.20.2.4 piece_random()

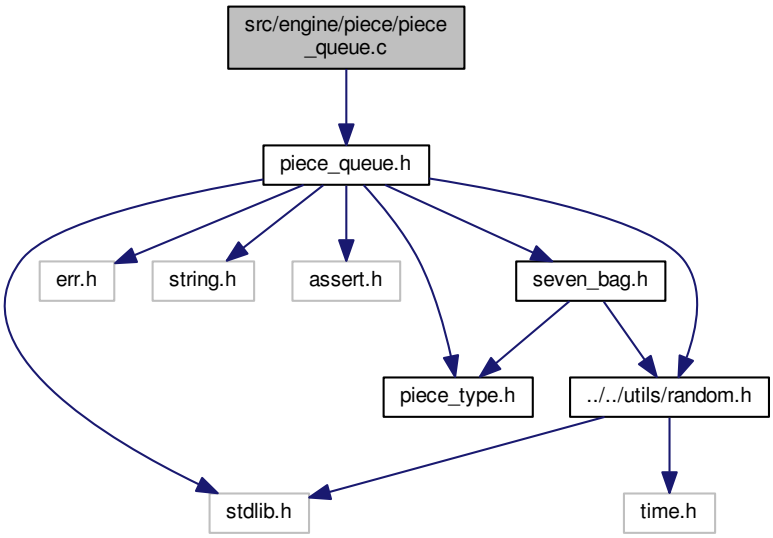
```
Piece* piece_random (
            int x,
            int y,
             Angle angle )
```

4.21 src/engine/piece/piece_queue.c File Reference

Piece (p. 9) queue.

```
#include "piece_queue.h"
```

Include dependency graph for piece_queue.c:



Functions

- **PieceQueue** * **piece_queue_create** (unsigned int seed)
- void **piece_queue_free** (**PieceQueue** *q)
- void **piece_queue_fill_data** (**PieceType** *data, size_t length)
- void **piece_queue_extend** (**PieceQueue** *q)
- **PieceType** **piece_queue_get** (**PieceQueue** *q, size_t index)

4.21.1 Detailed Description

Piece (p. 9) queue.

Author

S4MasterRace

Version

2.0

4.21.2 Function Documentation

4.21.2.1 piece_queue_create()

```
PieceQueue* piece_queue_create (
            unsigned int seed )
```

4.21.2.2 piece_queue_extend()

```
void piece_queue_extend (
             PieceQueue * q )
```

4.21.2.3 piece_queue_fill_data()

```
void piece_queue_fill_data (
             PieceType * data,
            size_t length )
```

4.21.2.4 piece_queue_free()

```
void piece_queue_free (
             PieceQueue * q )
```

4.21.2.5 piece_queue_get()

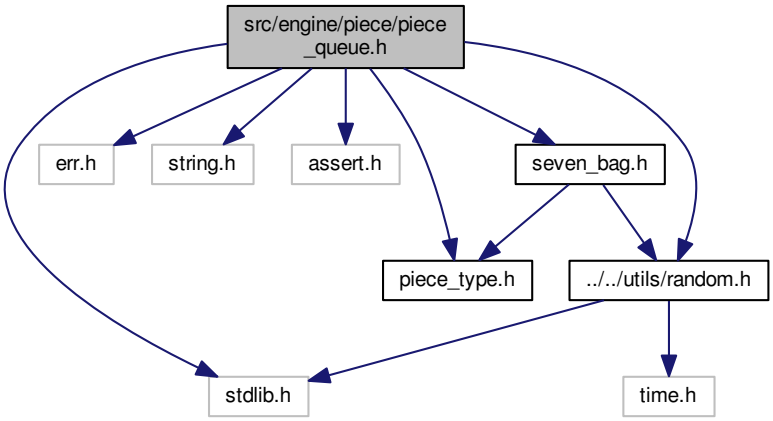
```
PieceType piece_queue_get (
             PieceQueue * q,
            size_t index )
```

4.22 src/engine/piece/piece_queue.h File Reference

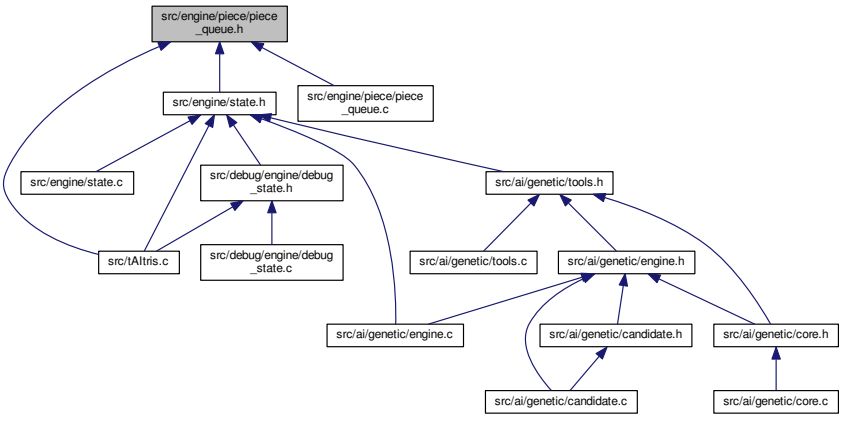
Piece (p. 9) queue.

```
#include <stdlib.h>
#include <err.h>
#include <string.h>
#include <assert.h>
#include "piece_type.h"
#include "seven_bag.h"
#include "../../utils/random.h"
```

Include dependency graph for piece_queue.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct **PieceQueue**

Macros

- #define **PIECE_QUEUE_LENGTH** 100

Functions

- **PieceQueue** * **piece_queue_create** (unsigned int seed)
- void **piece_queue_free** (**PieceQueue** *q)
- void **piece_queue_fill_data** (**PieceType** *data, size_t length)
- void **piece_queue_extend** (**PieceQueue** *q)
- **PieceType** **piece_queue_get** (**PieceQueue** *q, size_t index)

4.22.1 Detailed Description

Piece (p. 9) queue.

Author

S4MasterRace

Version

2.0

4.22.2 Macro Definition Documentation

4.22.2.1 PIECE_QUEUE_LENGTH

```
#define PIECE_QUEUE_LENGTH 100
```

4.22.3 Function Documentation

4.22.3.1 piece_queue_create()

```
PieceQueue* piece_queue_create (
            unsigned int seed )
```

4.22.3.2 piece_queue_extend()

```
void piece_queue_extend (
              PieceQueue * q )
```

4.22.3.3 piece_queue_fill_data()

```
void piece_queue_fill_data (
              PieceType * data,
             size_t length )
```

4.22.3.4 piece_queue_free()

```
void piece_queue_free (
              PieceQueue * q )
```

4.22.3.5 piece_queue_get()

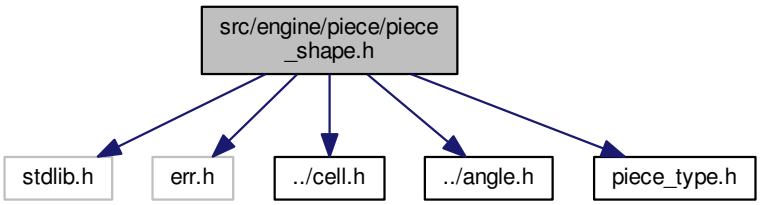
```
PieceType piece_queue_get (
              PieceQueue * q,
             size_t index )
```

4.23 src/engine/piece/piece_shape.h File Reference

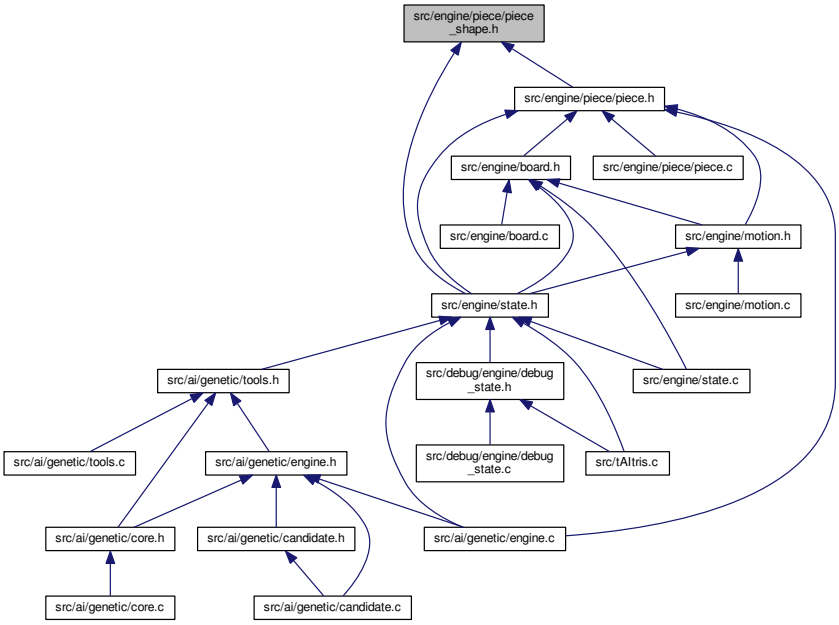
Piece (p. 9) shape.

```
#include <stdlib.h>
#include <err.h>
#include "../cell.h"
#include "../angle.h"
#include "piece_type.h"
```

Include dependency graph for piece_shape.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct **PieceShape**

Macros

- #define **PIECE_SHAPE_WIDTH** 4
- #define **PIECE_SHAPE_HEIGHT** 4

4.23.1 Detailed Description

Piece (p. 9) shape.

Author

S4MasterRace

Version

2.0

4.23.2 Macro Definition Documentation

4.23.2.1 PIECE_SHAPE_HEIGHT

```
#define PIECE_SHAPE_HEIGHT 4
```

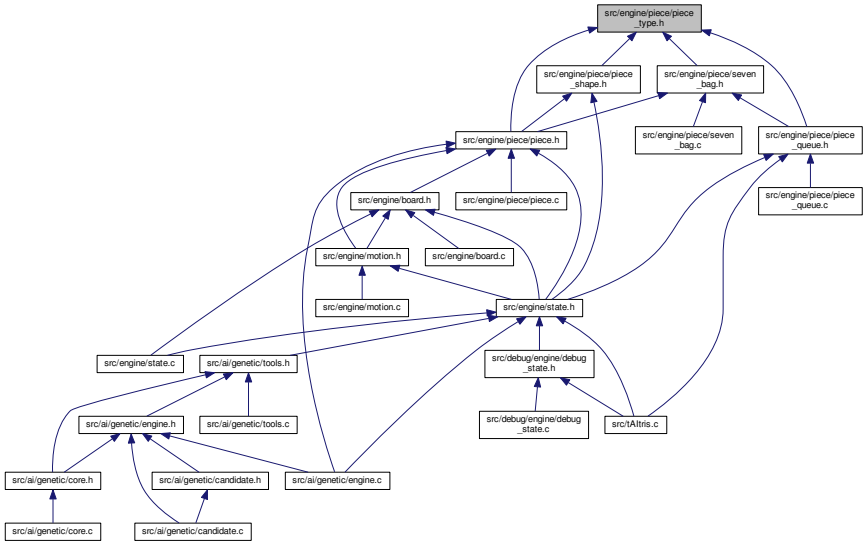
4.23.2.2 PIECE_SHAPE_WIDTH

```
#define PIECE_SHAPE_WIDTH 4
```

4.24 src/engine/piece/piece_type.h File Reference

Piece (p. 9) type.

This graph shows which files directly or indirectly include this file:



Macros

- #define **PIECE_TYPE_ESIZE** 7

Enumerations

- enum **PieceType** {
  PIECE_TYPE_I, **PIECE_TYPE_O**, **PIECE_TYPE_T**, **PIECE_TYPE_L**,
  PIECE_TYPE_J, **PIECE_TYPE_Z**, **PIECE_TYPE_S** }

4.24.1 Detailed Description

Piece (p. 9) type.

Author

S4MasterRace

Version

2.0

4.24.2 Macro Definition Documentation

4.24.2.1 PIECE_TYPE_ESIZE

```
#define PIECE_TYPE_ESIZE 7
```

4.24.3 Enumeration Type Documentation

4.24.3.1 PieceType

```
enum PieceType
```

Enumerator

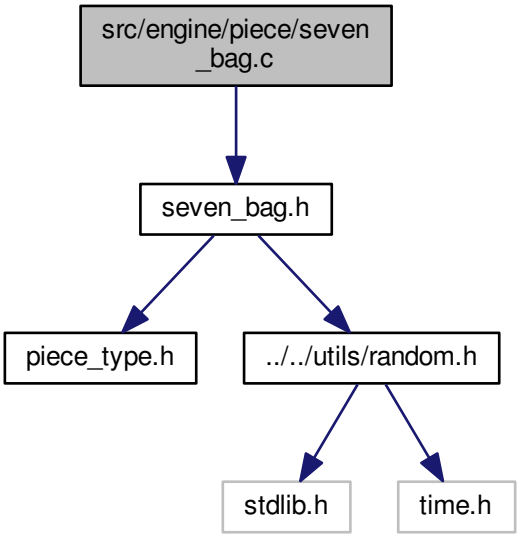
PIECE_TYPE_I	
PIECE_TYPE_O	
PIECE_TYPE_T	
PIECE_TYPE_L	
PIECE_TYPE_J	
PIECE_TYPE_Z	
PIECE_TYPE_S	

4.25 src/engine/piece/seven_bag.c File Reference

7-Bag generator

```
#include "seven_bag.h"
```

Include dependency graph for seven_bag.c:



Functions

- void **seven_bag_init** (**PieceType** *bag)
- void **seven_bag_swap** (**PieceType** *a, **PieceType** *b)
- void **seven_bag_shuffle** (**PieceType** *bag)
- **PieceType** **seven_bag_draw** ()

4.25.1 Detailed Description

7-Bag generator

Author

S4MasterRace

Version

2.0

4.25.2 Function Documentation

4.25.2.1 seven_bag_draw()

```
PieceType seven_bag_draw ( )
```

4.25.2.2 seven_bag_init()

```
void seven_bag_init (
            PieceType * bag )
```

4.25.2.3 seven_bag_shuffle()

```
void seven_bag_shuffle (
            PieceType * bag )
```

4.25.2.4 seven_bag_swap()

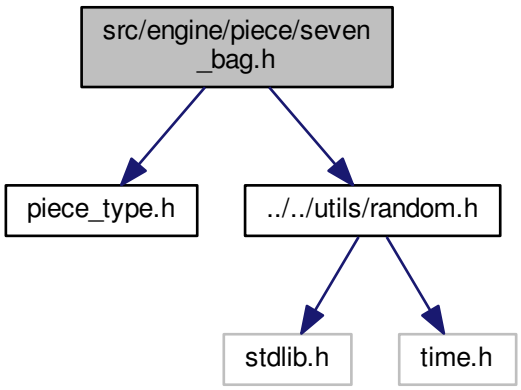
```
void seven_bag_swap (
            PieceType * a,
            PieceType * b )
```

4.26 src/engine/piece/seven_bag.h File Reference

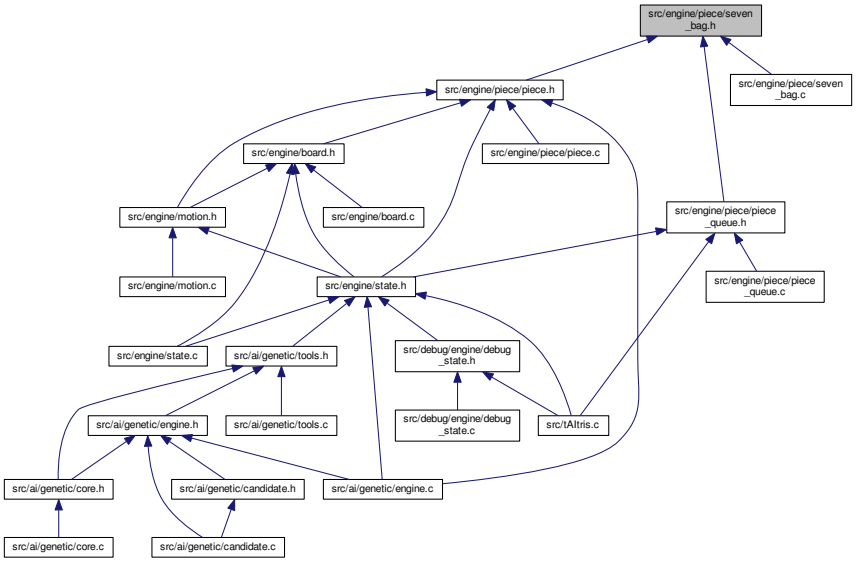
7-Bag generator

```
#include "piece_type.h"
#include "../../utils/random.h"
```

Include dependency graph for seven_bag.h:



This graph shows which files directly or indirectly include this file:



Functions

- void **seven_bag_init** (**PieceType** ∗bag)
- void **seven_bag_swap** (**PieceType** ∗a, **PieceType** ∗b)
- void **seven_bag_shuffle** (**PieceType** ∗bag)
- **PieceType** **seven_bag_draw** ()

4.26.1 Detailed Description

7-Bag generator

Author

S4MasterRace

Version

2.0

4.26.2 Function Documentation

4.26.2.1 seven_bag_draw()

```
PieceType seven_bag_draw ( )
```

4.26.2.2 seven_bag_init()

```
void seven_bag_init (
              PieceType * bag )
```

4.26.2.3 seven_bag_shuffle()

```
void seven_bag_shuffle (
              PieceType * bag )
```

4.26.2.4 seven_bag_swap()

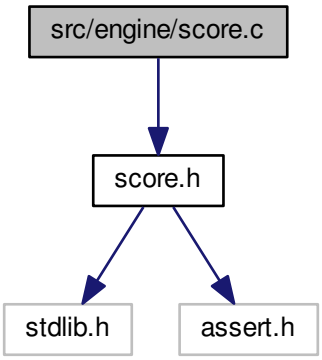
```
void seven_bag_swap (
              PieceType * a,
              PieceType * b )
```

4.27 src/engine/score.c File Reference

Scoring system.

```
#include "score.h"
```

Include dependency graph for score.c:



Functions

- unsigned int **score_compute_break** (const int hist[ ], size_t len, unsigned int level)

4.27.1 Detailed Description

Scoring system.

Author

S4MasterRace

Version

2.0

4.27.2 Function Documentation

4.27.2.1 score_compute_break()

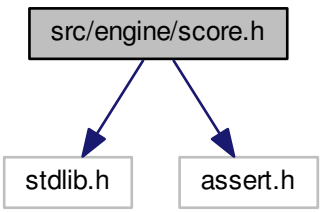
```
unsigned int score_compute_break (
            const int hist[],
            size_t len,
            unsigned int level )
```

4.28 src/engine/score.h File Reference

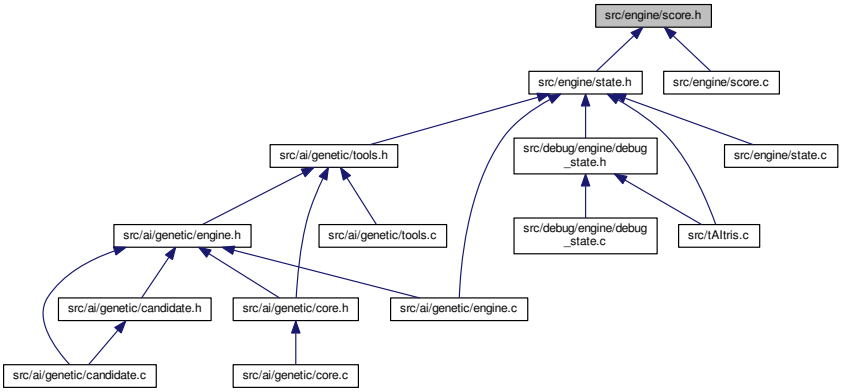
Scoring system.

```
#include <stdlib.h>
#include <assert.h>
```

Include dependency graph for score.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define **SCORE_SINGLE** 100
- #define **SCORE_DOUBLE** 300
- #define **SCORE_TRIPLE** 500
- #define **SCORE_TETRIS** 800
- #define **SCORE_SDROP** 1
- #define **SCORE_HDROP** 2
- #define **SCORE_LVL_PER_LINE** 10

Functions

- unsigned int **score_compute_break** (const int hist[ ], size_t len, unsigned int level)

4.28.1 Detailed Description

Scoring system.

Author

S4MasterRace

Version

2.0

4.28.2 Macro Definition Documentation

4.28.2.1 SCORE_DOUBLE

```
#define SCORE_DOUBLE 300
```

4.28.2.2 SCORE_HDROP

```
#define SCORE_HDROP 2
```

4.28.2.3 SCORE_LVL_PER_LINE

```
#define SCORE_LVL_PER_LINE 10
```

4.28.2.4 SCORE_SDROP

```
#define SCORE_SDROP 1
```

4.28.2.5 SCORE_SINGLE

```
#define SCORE_SINGLE 100
```

4.28.2.6 SCORE_TETRIS

```
#define SCORE_TETRIS 800
```

4.28.2.7 SCORE_TRIPLE

```
#define SCORE_TRIPLE 500
```

4.28.3 Function Documentation

4.28.3.1 score_compute_break()

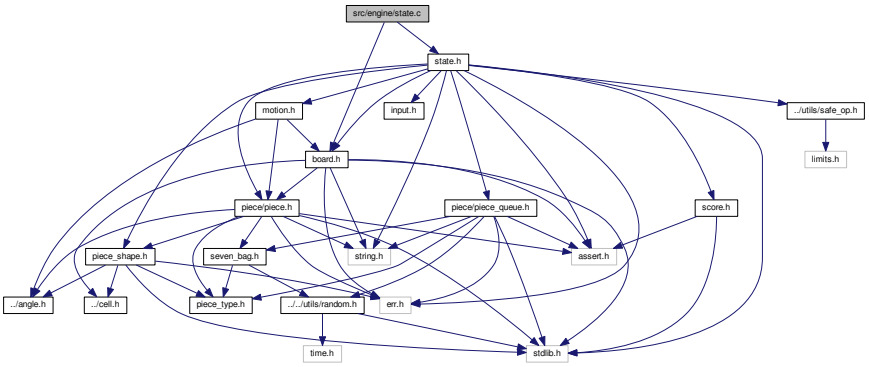
```
unsigned int score_compute_break (
            const int hist[],
            size_t len,
            unsigned int level )
```

4.29 src/engine/state.c File Reference

State (p. 12).

```
#include "state.h"
#include "board.h"
```

Include dependency graph for state.c:



Functions

- **State** ∗ **state_create** ()
- void **state_init** (**State** ∗state, **PieceQueue** ∗q)
- void **state_free** (**State** ∗state)
- **State** ∗ **state_copy** (const **State** ∗state)
- **Piece** ∗ **state_create_piece** (**State** ∗state)
- void **state_next_piece** (**State** ∗state)
- int **state_step** (**State** ∗state)
- int **state_apply_input** (**State** ∗state, **Input** input)
- int **state_apply_inputs** (**State** ∗state, **Input** input[ ], size_t len)
- int **state_can_apply_input** (**State** ∗state, **Input** input)
- int **state_can_apply_inputs** (**State** ∗state, **Input** input[ ], size_t len)

4.29.1 Detailed Description

State (p. 12).

Author

S4MasterRace

Version

2.0

4.29.2 Function Documentation

4.29.2.1 state_apply_input()

```
int state_apply_input (
              State * state,
              Input input )
```

4.29.2.2 state_apply_inputs()

```
int state_apply_inputs (
              State * state,
              Input input[],
             size_t len )
```

4.29.2.3 state_can_apply_input()

```
int state_can_apply_input (
              State * state,
              Input input )
```

4.29.2.4 state_can_apply_inputs()

```
int state_can_apply_inputs (
              State * state,
              Input input[],
             size_t len )
```

4.29.2.5 state_copy()

```
State* state_copy (
             const  State * state )
```

4.29.2.6 state_create()

```
State* state_create ( )
```

4.29.2.7 state_create_piece()

```
Piece* state_create_piece (
            State * state )
```

4.29.2.8 state_free()

```
void state_free (
            State * state )
```

4.29.2.9 state_init()

```
void state_init (
            State * state,
            PieceQueue * q )
```

4.29.2.10 state_next_piece()

```
void state_next_piece (
            State * state )
```

4.29.2.11 state_step()

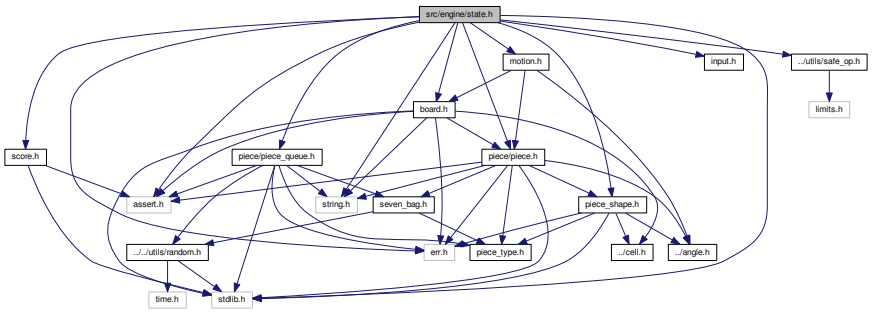
```
int state_step (
            State * state )
```

4.30 src/engine/state.h File Reference

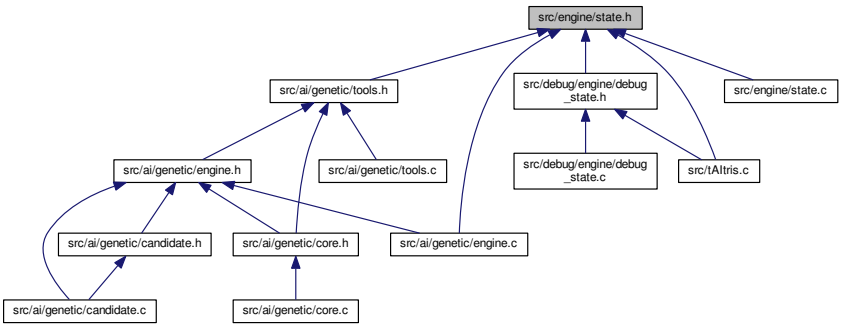
State (p. 12).

```
#include <stdlib.h>
#include <err.h>
#include <string.h>
#include <assert.h>
#include "board.h"
#include "piece/piece.h"
#include "piece/piece_shape.h"
#include "piece/piece_queue.h"
#include "motion.h"
#include "input.h"
#include "score.h"
#include "../utils/safe_op.h"
```

Include dependency graph for state.h:



This graph shows which files directly or indirectly include this file:



Data Structures

- struct **State**

Functions

- **State** * **state_create** ()
- void **state_init** (**State** *state, **PieceQueue** *q)
- void **state_free** (**State** *state)
- **State** * **state_copy** (const **State** *state)
- **Piece** * **state_create_piece** (**State** *state)
- void **state_next_piece** (**State** *state)
- int **state_step** (**State** *state)
- int **state_apply_input** (**State** *state, **Input** input)
- int **state_apply_inputs** (**State** *state, **Input** input[ ], size_t len)
- int **state_can_apply_input** (**State** *state, **Input** input)
- int **state_can_apply_inputs** (**State** *state, **Input** input[ ], size_t len)

4.30.1 Detailed Description

State (p. 12).

Author

S4MasterRace

Version

2.0

4.30.2 Function Documentation

4.30.2.1 state_apply_input()

```
int state_apply_input (
              State * state,
              Input input )
```

4.30.2.2 state_apply_inputs()

```
int state_apply_inputs (
              State * state,
              Input input[],
             size_t len )
```

4.30.2.3 state_can_apply_input()

```
int state_can_apply_input (
              State * state,
              Input input )
```

4.30.2.4 state_can_apply_inputs()

```
int state_can_apply_inputs (
              State * state,
              Input input[],
             size_t len )
```

4.30.2.5 state_copy()

```
 State* state_copy (
             const  State * state )
```

4.30.2.6 state_create()

```
 State* state_create ( )
```

4.30.2.7 state_create_piece()

```
 Piece* state_create_piece (
              State * state )
```

4.30.2.8 state_free()

```
void state_free (
              State * state )
```

4.30.2.9 state_init()

```
void state_init (
                State * state,
                PieceQueue * q )
```

4.30.2.10 state_next_piece()

```
void state_next_piece (
                State * state )
```

4.30.2.11 state_step()

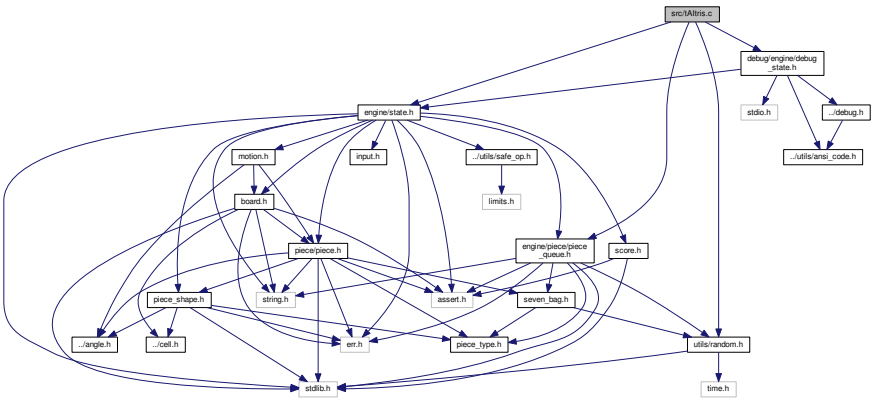
```
int state_step (
                State * state )
```

4.31 src/tAltris.c File Reference

Main file.

```
#include "utils/random.h"
#include "engine/piece/piece_queue.h"
#include "engine/state.h"
#include "debug/engine/debug_state.h"
```

Include dependency graph for tAltris.c:



Functions

- int **main** ()

4.31.1 Detailed Description

Main file.

Author

S4MasterRace

Version

2.0

4.31.2 Function Documentation

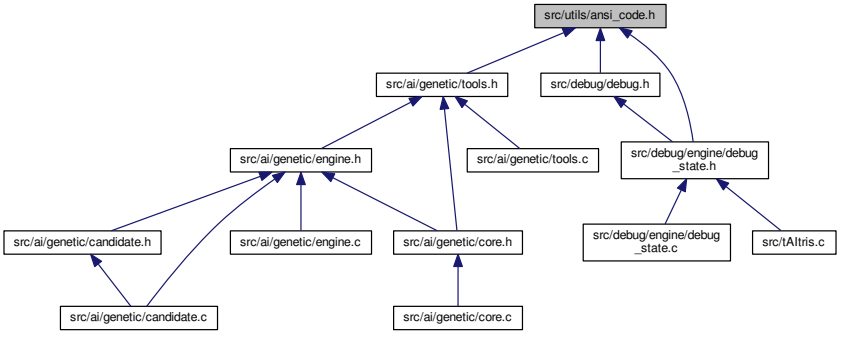
4.31.2.1 main()

```
int main ( )
```

4.32 src/utils/ansi_code.h File Reference

ANSI escape code.

This graph shows which files directly or indirectly include this file:



Macros

- #define **ANSI_ESC** "\x1b"
- #define **ANSI_SGR**(_code_) **ANSI_ESC** "[" #_code_ "m"
- #define **ANSI_RESET** **ANSI_SGR**(0)
- #define **ANSI_BOLD** **ANSI_SGR**(1)
- #define **ANSI_FAINT** **ANSI_SGR**(2)
- #define **ANSI_ITALIC** **ANSI_SGR**(3)
- #define **ANSI_UNDERLINE** **ANSI_SGR**(4)
- #define **ANSI_SBLINK** **ANSI_SGR**(5)
- #define **ANSI_RBLINK** **ANSI_SGR**(6)
- #define **ANSI_CROSSEDOUT** **ANSI_SGR**(9)
- #define **ANSI_FRAMED** **ANSI_SGR**(51)
- #define **ANSI_ENCIRCLED** **ANSI_SGR**(52)
- #define **ANSI_OVERLINED** **ANSI_SGR**(53)
- #define **ANSI_FG_DEFAULT** **ANSI_SGR**(39)
- #define **ANSI_FG_BLACK** **ANSI_SGR**(30)
- #define **ANSI_FG_RED** **ANSI_SGR**(31)
- #define **ANSI_FG_GREEN** **ANSI_SGR**(32)
- #define **ANSI_FG_YELLOW** **ANSI_SGR**(33)
- #define **ANSI_FG_BLUE** **ANSI_SGR**(34)
- #define **ANSI_FG_MAGENTA** **ANSI_SGR**(35)
- #define **ANSI_FG_CYAN** **ANSI_SGR**(36)
- #define **ANSI_FG_WHITE** **ANSI_SGR**(37)
- #define **ANSI_FG_BBLACK** **ANSI_SGR**(90)
- #define **ANSI_FG_BRED** **ANSI_SGR**(91)
- #define **ANSI_FG_BGREEN** **ANSI_SGR**(92)
- #define **ANSI_FG_BYELLOW** **ANSI_SGR**(93)
- #define **ANSI_FG_BBLUE** **ANSI_SGR**(94)
- #define **ANSI_FG_BMAGENTA** **ANSI_SGR**(95)
- #define **ANSI_FG_BCYAN** **ANSI_SGR**(96)
- #define **ANSI_FG_BWHITE** **ANSI_SGR**(97)
- #define **ANSI_BG_DEFAULT** **ANSI_SGR**(49)
- #define **ANSI_BG_BLACK** **ANSI_SGR**(40)
- #define **ANSI_BG_RED** **ANSI_SGR**(41)
- #define **ANSI_BG_GREEN** **ANSI_SGR**(42)
- #define **ANSI_BG_YELLOW** **ANSI_SGR**(43)
- #define **ANSI_BG_BLUE** **ANSI_SGR**(44)
- #define **ANSI_BG_MAGENTA** **ANSI_SGR**(45)
- #define **ANSI_BG_CYAN** **ANSI_SGR**(46)
- #define **ANSI_BG_WHITE** **ANSI_SGR**(47)
- #define **ANSI_BG_BBLACK** **ANSI_SGR**(100)
- #define **ANSI_BG_BRED** **ANSI_SGR**(101)
- #define **ANSI_BG_BGREEN** **ANSI_SGR**(102)
- #define **ANSI_BG_BYELLOW** **ANSI_SGR**(103)
- #define **ANSI_BG_BBLUE** **ANSI_SGR**(104)
- #define **ANSI_BG_BMAGENTA** **ANSI_SGR**(105)
- #define **ANSI_BG_BCYAN** **ANSI_SGR**(106)
- #define **ANSI_BG_BWHITE** **ANSI_SGR**(107)

4.32.1 Detailed Description

ANSI escape code.

Author

S4MasterRace

Version

2.0

4.32.2 Macro Definition Documentation

4.32.2.1 ANSI_BG_BBLACK

```
#define ANSI_BG_BBLACK  ANSI_SGR(100)
```

4.32.2.2 ANSI_BG_BBLUE

```
#define ANSI_BG_BBLUE  ANSI_SGR(104)
```

4.32.2.3 ANSI_BG_BCYAN

```
#define ANSI_BG_BCYAN  ANSI_SGR(106)
```

4.32.2.4 ANSI_BG_BGREEN

```
#define ANSI_BG_BGREEN  ANSI_SGR(102)
```

4.32.2.5 ANSI_BG_BLACK

```
#define ANSI_BG_BLACK  ANSI_SGR(40)
```

4.32.2.6 ANSI_BG_BLUE

```
#define ANSI_BG_BLUE  ANSI_SGR(44)
```

4.32.2.7 ANSI_BG_BMAGENTA

```
#define ANSI_BG_BMAGENTA  ANSI_SGR(105)
```

4.32.2.8 ANSI_BG_BRED

```
#define ANSI_BG_BRED  ANSI_SGR(101)
```

4.32.2.9 ANSI_BG_BWHITE

```
#define ANSI_BG_BWHITE  ANSI_SGR(107)
```

4.32.2.10 ANSI_BG_BYELLOW

```
#define ANSI_BG_BYELLOW  ANSI_SGR(103)
```

4.32.2.11 ANSI_BG_CYAN

```
#define ANSI_BG_CYAN  ANSI_SGR(46)
```

4.32.2.12 ANSI_BG_DEFAULT

```
#define ANSI_BG_DEFAULT  ANSI_SGR(49)
```

4.32.2.13 ANSI_BG_GREEN

```
#define ANSI_BG_GREEN  ANSI_SGR(42)
```

4.32.2.14 ANSI_BG_MAGENTA

```
#define ANSI_BG_MAGENTA  ANSI_SGR(45)
```

4.32.2.15 ANSI_BG_RED

```
#define ANSI_BG_RED  ANSI_SGR(41)
```

4.32.2.16 ANSI_BG_WHITE

```
#define ANSI_BG_WHITE  ANSI_SGR(47)
```

4.32.2.17 ANSI_BG_YELLOW

```
#define ANSI_BG_YELLOW  ANSI_SGR(43)
```

4.32.2.18 ANSI_BOLD

```
#define ANSI_BOLD  ANSI_SGR(1)
```

4.32.2.19 ANSI_CROSSEDOUT

```
#define ANSI_CROSSEDOUT  ANSI_SGR(9)
```

4.32.2.20 ANSI_ENCIRCLED

```
#define ANSI_ENCIRCLED  ANSI_SGR(52)
```

4.32.2.21 ANSI_ESC

```
#define ANSI_ESC "\x1b"
```

4.32.2.22 ANSI_FAINT

```
#define ANSI_FAINT  ANSI_SGR(2)
```

4.32.2.23 ANSI_FG_BBLACK

```
#define ANSI_FG_BBLACK  ANSI_SGR(90)
```

4.32.2.24 ANSI_FG_BBLUE

```
#define ANSI_FG_BBLUE  ANSI_SGR(94)
```

4.32.2.25 ANSI_FG_BCYAN

```
#define ANSI_FG_BCYAN  ANSI_SGR(96)
```

4.32.2.26 ANSI_FG_BGREEN

```
#define ANSI_FG_BGREEN  ANSI_SGR(92)
```

4.32.2.27 ANSI_FG_BLACK

```
#define ANSI_FG_BLACK  ANSI_SGR(30)
```

4.32.2.28 ANSI_FG_BLUE

```
#define ANSI_FG_BLUE  ANSI_SGR(34)
```

4.32.2.29 ANSI_FG_BMAGENTA

```
#define ANSI_FG_BMAGENTA  ANSI_SGR(95)
```

4.32.2.30 ANSI_FG_BRED

```
#define ANSI_FG_BRED  ANSI_SGR(91)
```

4.32.2.31 ANSI_FG_BWHITE

```
#define ANSI_FG_BWHITE  ANSI_SGR(97)
```

4.32.2.32 ANSI_FG_BYELLOW

```
#define ANSI_FG_BYELLOW  ANSI_SGR(93)
```

4.32.2.33 ANSI_FG_CYAN

```
#define ANSI_FG_CYAN  ANSI_SGR(36)
```

4.32.2.34 ANSI_FG_DEFAULT

```
#define ANSI_FG_DEFAULT  ANSI_SGR(39)
```

4.32.2.35 ANSI_FG_GREEN

```
#define ANSI_FG_GREEN  ANSI_SGR(32)
```

4.32.2.36 ANSI_FG_MAGENTA

```
#define ANSI_FG_MAGENTA  ANSI_SGR(35)
```

4.32.2.37 ANSI_FG_RED

```
#define ANSI_FG_RED  ANSI_SGR(31)
```

4.32.2.38 ANSI_FG_WHITE

```
#define ANSI_FG_WHITE  ANSI_SGR(37)
```

4.32.2.39 ANSI_FG_YELLOW

```
#define ANSI_FG_YELLOW  ANSI_SGR(33)
```

4.32.2.40 ANSI_FRAMED

```
#define ANSI_FRAMED  ANSI_SGR(51)
```

4.32.2.41 ANSI_ITALIC

```
#define ANSI_ITALIC  ANSI_SGR(3)
```

4.32.2.42 ANSI_OVERLINED

```
#define ANSI_OVERLINED  ANSI_SGR(53)
```

4.32.2.43 ANSI_RBLINK

```
#define ANSI_RBLINK  ANSI_SGR(6)
```

4.32.2.44 ANSI_RESET

```
#define ANSI_RESET  ANSI_SGR(0)
```

4.32.2.45 ANSI_SBLINK

```
#define ANSI_SBLINK  ANSI_SGR(5)
```

4.32.2.46 ANSI_SGR

```
#define ANSI_SGR(
              _code_ )  ANSI_ESC "[" #_code_ "m"
```

4.32.2.47 ANSI_UNDERLINE

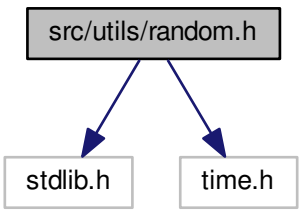
```
#define ANSI_UNDERLINE  ANSI_SGR(4)
```

4.33 src/utils/random.h File Reference

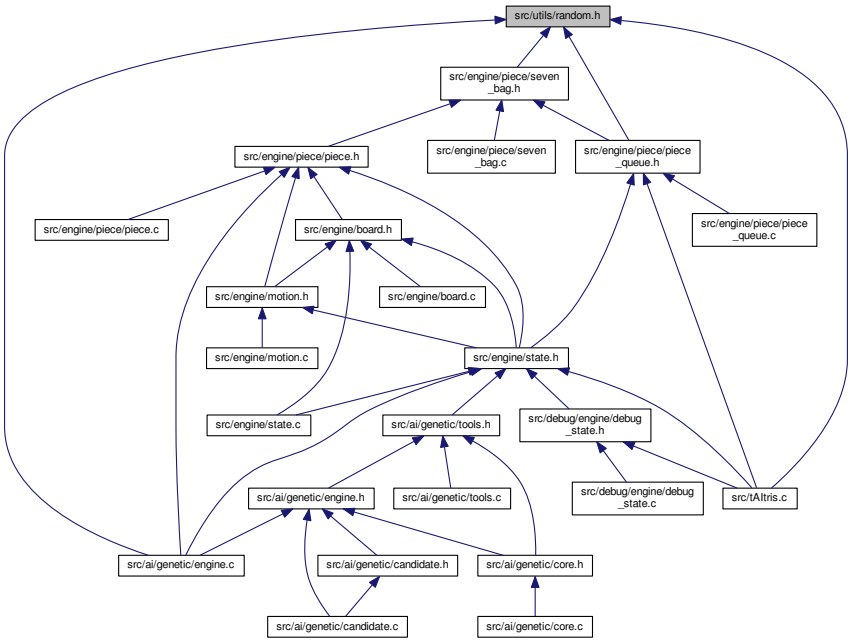
Random number generation.

```
#include <stdlib.h>
#include <time.h>
```

Include dependency graph for random.h:



This graph shows which files directly or indirectly include this file:



4.33.1 Detailed Description

Random number generation.

Author

S4MasterRace

Version

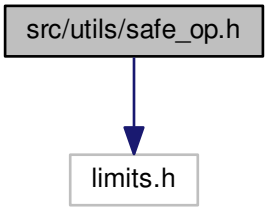
2.0

4.34 src/utils/safe_op.h File Reference

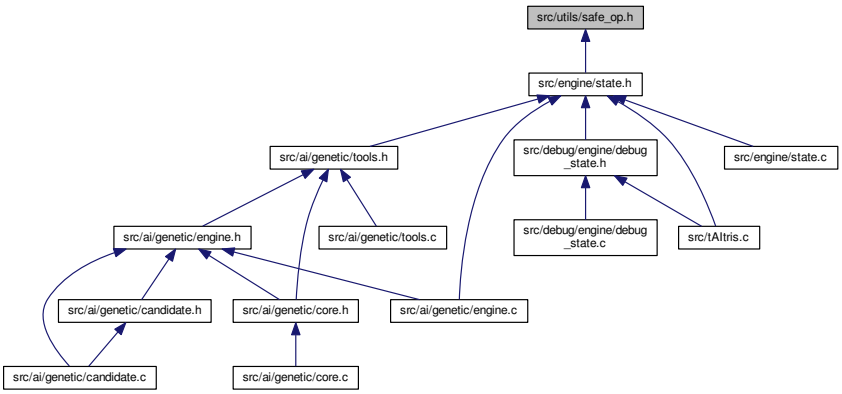
Safe operations.

```
#include <limits.h>
```

Include dependency graph for safe_op.h:



This graph shows which files directly or indirectly include this file:



Macros

- #define **SAFE_OP_SUCCESS** 0
- #define **SAFE_OP_OVERFLOW** 1
- #define **SAFE_OP_UNDERFLOW** (-1)

4.34.1 Detailed Description

Safe operations.

Author

S4MasterRace

Version

2.0

4.34.2 Macro Definition Documentation

4.34.2.1 SAFE_OP_OVERFLOW

```
#define SAFE_OP_OVERFLOW 1
```

4.34.2.2 SAFE_OP_SUCCESS

```
#define SAFE_OP_SUCCESS 0
```

4.34.2.3 SAFE_OP_UNDERFLOW

```
#define SAFE_OP_UNDERFLOW (-1)
```

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