WORDLEXPR

COMPILE-TIME WORDLE

...just why?

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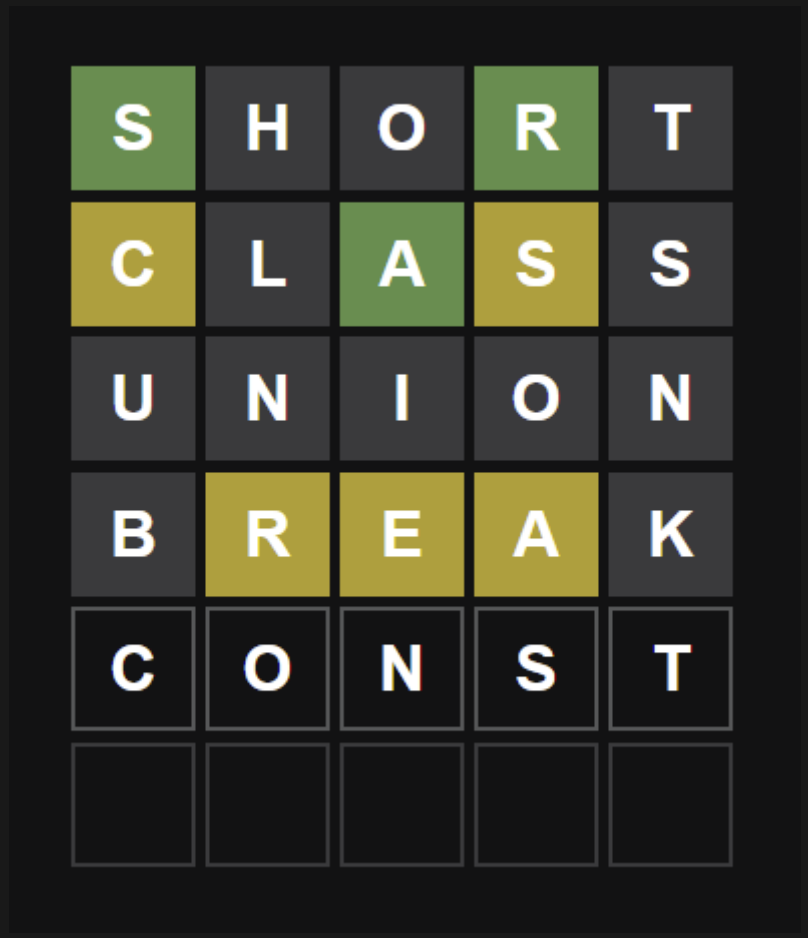
https://github.com/vittorioromeo/accu2022


SHORT
CLASS
UNION
BREAK
CONST

```
❯ g++ -std=c++20 ./wordlexpr.cpp
```

The entire game is played with compiler errors!
No executable ever gets generated.

```
❯ g++ -std=c++20 ./wordlexpr.cpp
./wordlexpr.cpp:2593:7: error: variable 'print<ct_str{"Welcome to Wordlexpr! In order to play, please pass a seed to y
our compiler with `-DSEED=<number>`. An existing letter in the right spot will be reported as `o`. An existing letter
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 has initializer but incomplete type
 2593 |     > _{};
      |       ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456
```

Random seed, guesses, and user state are passed as preprocessor defines to the compiler.

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./wordlexpr.cpp:2598:11: error: variable 'print<ct_str{"Please enter the first guess with `-DGUESS=<guess>`.", 52}> _'
 has initializer but incomplete type
 2598 |         > _{};
      |           ^

 /c/wordlexpr ..................................................................... 17:21:20
❯
```

```
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 /c/wordlexpr ..................................................................... 17:21:20
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❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=crane
./wordlexpr.cpp:2602:46: error: variable 'print<ct_str{"You guessed `crane`. Outcome: `x-xx-`. To continue the game, p
ass `-DSTATE=BJYHULLPUYCGKOTXBFJNSWAEIM` alongside a new guess.", 125}> _' has initializer but incomplete type
 2602 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^

 /c/wordlexpr ····· 17:21:30
❯
```

```
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Full explanation on:
https://vittorioromeo.com

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❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=crane -DSTATE=BJYHULLPUYCGKOTXBFJNSWAEIM
./wordlexpr.cpp:2612:46: error: variable 'print<ct_str{"Please enter a new guess before continuing.", 43}> _' has init
ializer but incomplete type
 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                               ^

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❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=crane -DSTATE=BJYHULLPUYCGKOTXBFJNSWAEIM
```

```
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 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=white -DSTATE=BJYHULLPUYCGKOTXBFJNSWAEIM
./wordlexpr.cpp:2612:46: error: variable 'print<ct_str{"You guessed `crane`. Outcome: `x-xx-`. You guessed `white`. Ou
tcome: `xxox-`. To continue the game, pass `-DSTATE=CJYHULDOPALGKOTXBFJNSWAEIM` alongside a new guess.", 164}> _' has
initializer but incomplete type
 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^

 /c/wordlexpr                                                                    17:21:55
❯
```

```
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      |           ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=crane
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 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=black -DSTATE=CJYHULDOPALGKOTXBFJNSWAEIM
./wordlexpr.cpp:2612:46: error: variable 'print<ct_str{"You guessed `crane`. Outcome: `x-xx-`. You guessed `white`. Ou
tcome: `xxox-`. You guessed `black`. Outcome: `xoxxx`. To continue the game, pass `-DSTATE=DJYHULDOPALISHJRBFJNSWAEIM`
 alongside a new guess.", 203}> _' has initializer but incomplete type
 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^

 /c/wordlexpr                                                                                    17:22:12
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=black -DSTATE=CJYHULDOPALGKOTXBFJNSWAEIM
```

```
 2602 |         print<make_full_str(SEED, guess, s)> _{};
      |                                               ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=crane -DSTATE=BJYHULLPUYCGKOTXBFJNSWAEIM
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      |                                               ^
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 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                               ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=tower -DSTATE=DJYHULDOPALISHJRBFJNSWAEIM
./wordlexpr.cpp:2612:46: error: variable 'print<ct_str{"You guessed `crane`. Outcome: `x-xx-`. You guessed `white`. Ou
tcome: `xxox-`. You guessed `black`. Outcome: `xoxxx`. You guessed `tower`. Outcome: `xxxoo`. To continue the game, pa
ss `-DSTATE=EJYHULDOPALISHJRAVDLYWAEIM` alongside a new guess.", 242}> _' has initializer but incomplete type
 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                               ^

 /c/wordlexpr ..................................................................... 17:22:27
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=tower -DSTATE=EJYHULDOPALISHJRAVDLYWAEIM
```

```
 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=white -DSTATE=BJYHULLPUYCGKOTXBFJNSWAEIM
./wordlexpr.cpp:2612:46: error: variable 'print<ct_str{"You guessed `crane`. Outcome: `x-xx-`. You guessed `white`. Ou
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 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=black -DSTATE=CJYHULDOPALGKOTXBFJNSWAEIM
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      |                                              ^
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 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^
❯ g++ -std=c++20 ./wordlexpr.cpp -DSEED=123456 -DGUESS=mower -DSTATE=EJYHULDOPALISHJRAVDLYWAEIM
./wordlexpr.cpp:2612:46: error: variable 'print<ct_str{"Unlucky -- you are out of guesses! The word was `flier`. Start
 a new game by changing `SEED` and undefining `STATE`.", 116}> _' has initializer but incomplete type
 2612 |         print<make_full_str(SEED, guess, s)> _{};
      |                                              ^

 /c/wordlexpr                                                                                    17:22:45
❯
```

TRY IT

- You can play Wordlexpr on Compiler Explorer: https://gcc.godbolt.org/z/4oo3PrvqY
- But how does it work…?

HIGH-LEVEL OVERVIEW

1. Produce arbitrary human-readable output as a compiler diagnostic
2. Random number generation at compile-time
3. Retain state and keep track of the player's progress in-between compilations

ERROR IS THE NEW PRINTF

- `static_assert` doesn't cut it
  - It only accepts a *string literal*

```
template <char...> struct print;
print<'a', 'b', 'c'> _{};
```

```
error: variable 'print<'a', 'b', 'c'> _'
       has initializer but incomplete type
    3 | print<'a', 'b', 'c'> _{};
      |
```

```cpp
struct ct_str
{
    char        _data[512]{};
    std::size_t _size{0};

    template <std::size_t N>
    constexpr ct_str(const char (&str)[N])
        : _data{}, _size{N - 1}
    {
        for(std::size_t i = 0; i < _size; ++i)
            _data[i] = str[i];
    }
};
```

```cpp
template <ct_str> struct print;
print<"Welcome to Wordlexpr!"> _{};
```

```cpp
constexpr ct_str test()
{
    ct_str s{"Hi XXCU!"};
    s._data[4] = 'A';
    s._data[5] = 'C';
    return s;
}

print<test()> _{};
```

```
error: variable 'print<ct_str{"Hi ACCU!", 9}> _' has
       initializer but incomplete type
   33 | print<test()> _{};
      |
```

COMPILE-TIME RNG

```
g++ -std=c++20 ./wordlexpr.cpp -DSEED=123
```

```
constexpr const ct_str& get_target_word()
{
    return wordlist[SEED % wordlist_size];
}
```

RETAINING STATE AND MAKING PROGRESS

```
g++ -std=c++20 ./wordlexpr.cpp -DSEED=123
    -DSTATE=DJYHULDOPALISHJRBFJNSWAEIM
```

```
struct state
{
    std::size_t _n_guesses{0};
    ct_str      _guesses[5];
};

constexpr ct_str encode_state(const state&  s);
constexpr state  decode_state(const ct_str& str);
```

THANKS!

vittorioromeo.com/index/blog/wordlexpr.html

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https://github.com/vittorioromeo/accu2022