debug hard

```
require 'test/unit'
require_relative ‘../introduction'

class IntroductionTest < Test::Unit::TestCase
  def test_introduction
    assert_equal(
      'Welcome to RubyConf Kenya',
      Introduction.new.method
    )
  end
end
```

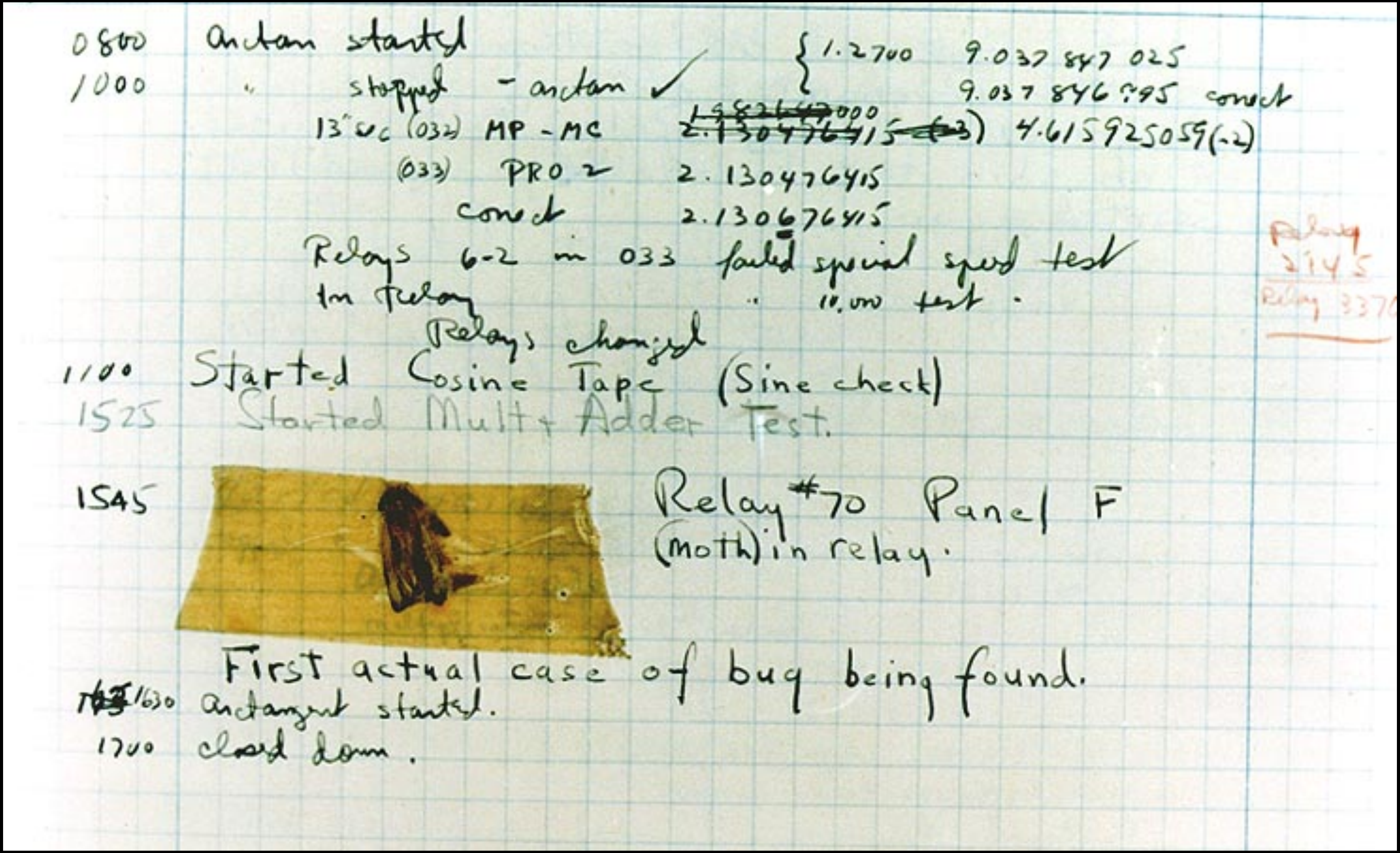
```
test/introduction_test.rb:2:in `require_relative’:

cannot load such file –

/Users/vishalchandnani/Technical-Talks/idea_1

/introduction/introduction (LoadError)

from test/introduction_test.rb:2:in `<main>'
```

```ruby
class Introduction

  def method
    'Welcome to RubyConf Kenya'
  end

end
```

```
Finished in 0.000394 seconds.
1 tests, 1 assertions, 0 failures, 0 errors
0 pendings, 0 omissions, 0 notifications
100% passed
```

```
def method
  'Welcome to RubyConf Kenya'
end
```

no bugs were harmed in the making of this talk once upon a time



0800 Antan started

1000 " stopped - antan ✓ { 1.2700 9.037 847 025
{ 9.037 846 795 correct

13" sec (032) MP - MC ~~1.982147000~~
~~2.130476415 (-3)~~) 4.615925059(-2)

(033) PRO 2 2.130476415

correct 2.130676415

Relays 6-2 in 033 failed special speed test
In relay " 10,000 test .

Relays changed

1100 Started Cosine Tape (Sine check)

1525 Started Mult + Adder Test.

1545 Relay #70 Panel F
(moth) in relay.

First actual case of bug being found.

1630 Antangent started.

1700 closed down.

Relay
2145
Relay 3370

COMO HOPPE

statement
standard
case
void
contains
array
variables
constant
function
POINTER
size
argument
zero
define
int
read
char
CHARACTER
USED
input
STRUCT
library
error
operator
double
structure
write
string
specifier
object
expression
declaration
external
NULL
INITIALIZED
PROGRAM
include
TYPE
CALLED
return
evaluated
RESULT
time

vbox

https://www.ruby-lang.org/en/documentation/installation/

https://www.ruby-lang.org/en/downloads/

Ruby Version: 2.5.1

ruby.c

#1
grep

```
$ grep -r rb_str_reverse *
```

string.c

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VANESSA REDGRAVE
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JACQUELINE BISSET
JEAN-PIERRE CASSEL
WENDY HILLER
ANTHONY PERKINS
RICHARD WIDMARK
MICHAEL YORK

File: test/ruby/test_string.rb

```ruby
require 'test/unit'

class TestString < Test::Unit::TestCase
  def test_reverse
    assert_equal(S("beta"), S("ateb").reverse)
    assert_equal(S("madamImadam"), S("madamImadam").reverse)

    a=S("beta")
    assert_equal(S("ateb"), a.reverse)
    assert_equal(S("beta"), a)
  end
end
```

```
File: string.c
/*
 *  call-seq:
 *    str.reverse. -> new_str
 *  Returns a new string with the characters from <i>str</i>
 *  in reverse order.
 *  “stressed”.reverse  #=> "desserts"
 */
static VALUE
rb_str_reverse(VALUE str)
{
  . . .
}
```

all you need to do

3 days later

debugger.rb

Raphaël

ïeahpaR

#2
chars

```
“Raphaël”.chars
```

```
[“R”, “a”, “p”, “h”, “a”, “e”, “̈”, “l”]
```

ë

unicode

Twelve terrorists. One cop.
The odds are against John McClane…
That's just the way he likes it.
BRUCE WILLIS
DIE HARD

#3
codepoints

```
“Raphaël”.codepoints do |c|
  puts “#{c} : 0x#{c.to_s(16)}”
end
```

```
“R” : 82  (0x52)
“a” : 97  (0x61)
“p” : 112 (0x70)
“h” : 104 (0x68)
“a” : 97  (0x61)
“e” : 101 (0x65)
“̈” : 776 (0x308)
“l” : 108 (0x6c)
```

#4

each_byte

```
“Raphaël”.each_byte do |c|
  puts “#{c} : 0x#{c.to_s(16)}”
end
```

```
“R”  : 82  (0x52)
“a”  : 97  (0x61)
“p”  : 112 (0x70)
“h”  : 104 (0x68)
“a”  : 97  (0x61)
“e”  : 101 (0x65)
“̈”   : 204 (0xcc) and 136 (0x88)
“l”  : 108 (0x6c)
```

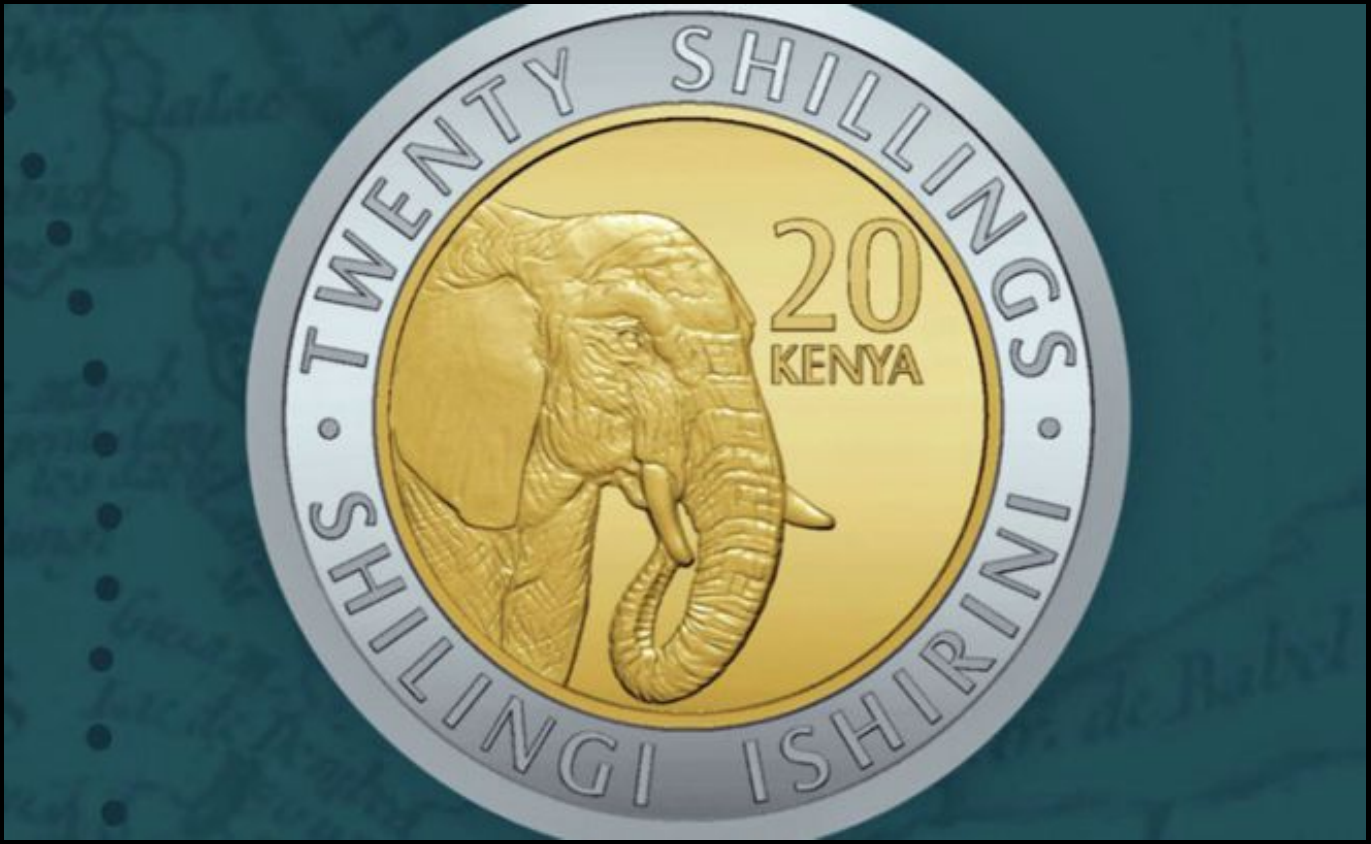
pointers

```
#include <stdio.h>
#include <string.h>

int main ( void ) {
  char str[25] = "hello world";
  char *ptr;

  for(ptr = str; *ptr != '\0'; ptr++) {
    printf("%c", *ptr);
  }
}
```

#5
printf

```
printf(“\n length: %d”, length);
```

```
static VALUE
rb_str_reverse(VALUE str)
{
  . . .
  while (s < e) {
    int clen = rb_enc_fast_mbclen(s, e, enc);
    printf("\nclen: %d", clen);
    p -= clen;
    memcpy(p, s, clen);
    s += clen;
  }
  . . .
}
```


TWENTY SHILLINGS
20
KENYA
SHILINGI ISHIRINI

#6
gdb

```
$ gdb ruby

(gdb) break string.c:5575

(gdb) run -Ilib debugger.rb

(gdb) s
```

```
$ gdb ruby

(gdb) break string.c:5575

(gdb) break regenc:62

(gdb) run -Ilib debugger.rb

(gdb) s
```

© James Warwick www.jameswarwick.co.uk

```
File: enc/utf_8.c

static int

mbc_enc_len(

const UChar* p,

const UChar* e,

OnigEncoding enc ARG_UNUSED) {

  . . .

  . . .

}
```

```
s: R 82 52
  clen: 1
s: a 97 61
  clen: 1
s: p 112 70
  clen: 1
s: h 104 68
  clen: 1
s: a 97 61
  clen: 1
s: e 101 65
  clen: 1
s: X -52 ffffffcc
  clen: 2
s: l 108 6c
  clen: 1
```

```
if(c1 == 'e') {
  vptr = s;
  *vptr = 0xc3;
  vptr++;
  *vptr = 0xab;
  vptr++;
  *vptr = 'l';
  vptr++;
  *vptr = '\0';
}
```

```
s: R 82 52
  clen: 1
s: a 97 61
  clen: 1
s: p 112 70
  clen: 1
s: h 104 68
  clen: 1
s: a 97 61
  clen: 1
s: e 101 65
  hack
  clen: 2
s: l 108 6c
  clen: 1
```

lëahpaR

unicode_normalize

Canonical Composition

```
irb> vc = “e\u0308”.unicode_normalize
=> “ë”
irb> vc.chars
=> [“ë”]
irb> vc.size
=> 1
```

Canonical Decomposition

```
irb> vc = “e\u0308”.unicode_normalize
=> “ë”
irb> vc.unicode_normalize(:nfd).chars
=> [“e”, “̈”]
irb> vc.unicode_normalize(:nfd).chars.size
=> 2
```

```
chars                       chars
before                      after

“R”                         “R”
“a”                         “a”
“p”                         “p”
“h”                         “h”
“a”                         “a”
“e”                         “ë”
“̈”                          “l”
“l”
```

```
code_points               code_points
before                    after

“R” : 82                  “R” : 82
“a” : 97                  “a” : 97
“p” : 112                 “p” : 112
“h” : 104                 “h” : 104
“a” : 97                  “a” : 97
“e” : 101                 “ë” : 235
“̈”  : 776                 “l” : 108
“l” : 108
```

```
each_byte

before


“R”   : 82   (0x52)

“a”   : 97   (0x61)

“p”   : 112  (0x70)

“h”   : 104  (0x68)

“a”   : 97   (0x61)

“e”   : 101  (0x65)

“̈”    : 204  (0xcc) and 136 (0x88)

“l”   : 108  (0x6c)
```

```
each_byte

after


“R” : 82   (0x52)

“a” : 97   (0x61)

“p” : 112  (0x70)

“h” : 104  (0x68)

“a” : 97.  (0x61)

“ë” : 195  (0xc3) and 171(0xab)

“l” : 108  (0x6c)
```

```
File: lib/unicode_normalize/normalize.rb

  def self.normalize(string, form = :nfc)
    . . .
    . . .
    case form
      when :nfc then
        string.gsub REGEXP_C, NF_HASH_C
      . . .
    . . .
  end
```

```
m1 = string[REGEXP_C]

regex match: “ë”

chars: [“e”, “̈”]

codepoints: [101, 776]

each byte iteration

101:0x65 | 204:0xcc | 136:0x88
```

```
m2 = NF_HASH_C[m1]

hash value: “ë”

chars: [“ë”]

codepoints: [235]

each byte iteration

195:0xc3 | 171:0xab
```

Raphaël

lëahpaR

```
def debug_hard
  grep
  chars
  code_points
  each_byte
  printf
  gdb
end
```

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