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Номер по списку: 21

«СИСТЕМЫ ПРОГРАММИРОВАНИЯ»
Курсовая работа 2021.
Часть 1.

Для заданного в Лабораторной №8 диалекта языка МИКРОЛИСП разработайте синтаксически управляемый транслятор на язык С++, применяя методику из Лабораторной №9, Правила TranslationRules21.rtf и TextLayout.txt .

Работоспособность транслятора проверьте на трех контрольных задачах из Лабораторной №8.

Шаблон файла code-gen.cpp создайте с помощью приложения Make-code-gen.cpp .

Вариант грамматики: j21

Контрольная задача №1 – zeller.

Полный скриншот трансляции без трассировки.

```
Source>zeller
Source:zeller.ss
   1|;zeller.ss
   2|(define (day-of-week)
   3| (zeller dd
   4|       (cond((< mm 3)(+ mm 10))(#t(- mm 2)))
   5|       (remainder (cond((< mm 3)(- yyyy 1))(#t yyyy))100)

   6|       (quotient (cond((< mm 3)(- yyyy 1))(#t yyyy))100)
   7| )
   8|)
   9|(define (zeller d m y c)
  10| (neg-to-pos (remainder (+ d y
  11|                           (quotient (-(* 26 m)2) 10)
  12|                           (quotient y 4)
  13|                           (quotient c 4)
  14|                           (* 2(- c))
  15|                        )
  16|             7)
  17| )
  18|)
```

```
 19|(define (neg-to-pos d)
 20| (cond((< d 0)(+ d 7))
 21|       (#t d)
 22| )
 23|)
 24|(define (birthday dw)
 25|;                  ^{0,...,6}
 26| (display "Your were born on ")
 27|    (display
 28|     (if(= dw 1)"Monday "
 29|          (if (= dw 2)"Tuesday "
 30|          (if (= dw 3)"Wednesday "
 31|          (if (= dw 4)"Thursday "
 32|          (if (= dw 5)"Friday "
 33|          (if (= dw 6)"Saturday "
 34|          "Sunday" )))))))
 35|  (display dd)(display ".")
 36|  (display mm)(display ".")
 37| yyyy
 38|)
 39|(define dd 31)
 40|(define mm 03)
 41|(define yyyy 2001)
 42|(birthday (day-of-week))
 43|
```

```
_________________
Code:
/*  MIP   */
#include "mlisp.h"
double day__of__week/*2*/ () ;
        double zeller/*9*/ (double d, double m
        , double y, double c) ;
        double neg__to__pos/*19*/ (double d) ;
        double birthday/*24*/ (double dw) ;
        extern double dd/*39*/;
        extern double mm/*40*/;
        extern double yyyy/*41*/;
        //_________________
double day__of__week/*2*/ () {
 return
 zeller(dd
        , ((mm < 3.)
       ? (mm + 10.)
       : true
       ? (mm - 2.)
       : _infinity)
        , remainder(((mm < 3.)
       ? (yyyy - 1.)
       : true
       ? yyyy
       : _infinity)
        , 100.)

        , quotient(((mm < 3.)
       ? (yyyy - 1.)
       : true
       ? yyyy
       : _infinity)
        , 100.)
```

```
         )
         ;
         }
double zeller/*9*/ (double d, double m
         , double y, double c) {
 return
 neg__to__pos(remainder((d + y + quotient(((26. * m) - 2.)
         , 10.)
          + quotient(y
         , 4.)
          + quotient(c
         , 4.)
          + (2. * (- c)))
         , 7.)
         );
         }
double neg__to__pos/*19*/ (double d) {
 return
 ((d < 0.)
        ? (d + 7.)
        : true
        ? d
        : _infinity);
         }
double birthday/*24*/ (double dw) {
 display("Your were born on ");
         display(((dw == 1.)
        ? "Monday "
        : ((dw == 2.)
        ? "Tuesday "
        : ((dw == 3.)
        ? "Wednesday "
        : ((dw == 4.)
        ? "Thursday "
        : ((dw == 5.)
        ? "Friday "
        : ((dw == 6.)
        ? "Saturday "
        : "Sunday")))))));
         display(dd);
         display(".");
         display(mm);
         display(".");
         return
 yyyy;
         }
double dd/*39*/ = 31.;
         double mm/*40*/ = 03.;
         double yyyy/*41*/ = 2001.;
         int main(){
 display(birthday(day__of__week()));
         newline();
         std::cin.get();
         return
 0;
         }

Code is saved to file zeller.cpp !
```

Распечатка файла zeller.cpp .

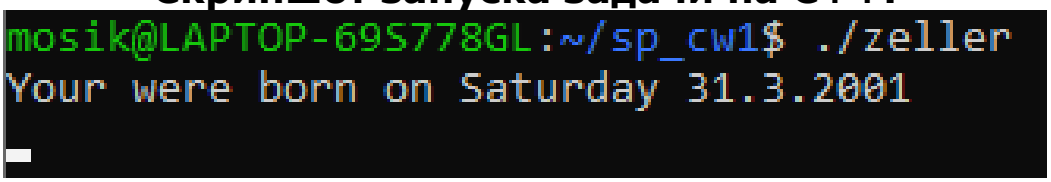
```
/*  MIP  */
#include "mlisp.h"
double day__of__week/*2*/ () ;
    double zeller/*9*/ (double d, double m
    , double y, double c) ;
    double neg__to__pos/*19*/ (double d) ;
    double birthday/*24*/ (double dw) ;
    extern double dd/*39*/;
    extern double mm/*40*/;
    extern double yyyy/*41*/;
    //____________________
double day__of__week/*2*/ () {
 return
 zeller(dd
    , ((mm < 3.)
   ? (mm + 10.)
   : true
   ? (mm - 2.)
   : _infinity)
    , remainder(((mm < 3.)
   ? (yyyy - 1.)
   : true
   ? yyyy
   : _infinity)
    , 100.)

    , quotient(((mm < 3.)
   ? (yyyy - 1.)
   : true
   ? yyyy
   : _infinity)
    , 100.)
    )
    ;
    }
double zeller/*9*/ (double d, double m
    , double y, double c) {
 return
 neg__to__pos(remainder((d + y + quotient(((26. * m) - 2.)
    , 10.)
     + quotient(y
```

```
    , 4.)
     + quotient(c
    , 4.)
     + (2. * (- c)))
    , 7.)
    );
    }
double neg__to__pos/*19*/ (double d) {
 return
 ((d < 0.)
   ? (d + 7.)
   : true
   ? d
   : _infinity);
    }
double birthday/*24*/ (double dw) {
 display("Your were born on ");
    display(((dw == 1.)
   ? "Monday "
   : ((dw == 2.)
   ? "Tuesday "
   : ((dw == 3.)
   ? "Wednesday "
   : ((dw == 4.)
   ? "Thursday "
   : ((dw == 5.)
   ? "Friday "
   : ((dw == 6.)
   ? "Saturday "
   : "Sunday")))))));
    display(dd);
    display(".");
    display(mm);
    display(".");
    return
 yyyy;
    }
double dd/*39*/ = 31.;
    double mm/*40*/ = 03.;
    double yyyy/*41*/ = 2001.;
    int main(){
 display(birthday(day__of__week()));
```

```
    newline();
    std::cin.get();
    return
0;
    }
```

Скриншот запуска задачи на C++.



Контрольная задача №2 – golden21.

Полный скриншот трансляции без трассировки.

```
Source>golden21
Source:golden21.ss
   1|;golden21
   2|(define a 2)(define b 6)
   3|(define (fun x)
   4| (set! x (- x (/ 21 22)))
   5| (-(expt(- x 3) 4) (expt(atan x) 3) 2)
   6|)
   7|(define (golden-section-search a b)
   8| (let(
   9|       (xmin(cond((< a b)(golden-start a b))(#t(golden-start b a ))))
  10|      )
  11|      (newline)
  12|      xmin
  13| )
  14|)
  15|(define (golden-start a b)
  16| (set! total-iterations 0)
  17| (let(
  18|       (xa (+ a (* mphi(- b a))))
  19|       (xb (+ b (-(* mphi(- b a)))))
  20|      )
  21|      (try a b xa (fun xa) xb (fun xb))
  22| )
  23|)
  24|(define mphi (* (- 3(sqrt 5))(/ 2e+0)))
  25|(define (try a b xa ya xb yb)
  26| (cond((close-enough? a b)
  27|       (* (+ a b)5e-1))
  28|       (#t(display "+")
  29|              (set! total-iterations (+ total-iterations 1))
  30|              (cond((< ya yb)(set! b xb)
  31|                           (set! xb xa)
  32|                           (set! yb ya)
  33|                           (set! xa (+ a (* mphi(- b a))))
  34|                           (try a b xa (fun xa) xb yb)
  35|                  )
```

```
 36|                  (#t    (set! a xa)
 37|                         (set! xa xb)
 38|                         (set! ya yb)
 39|                         (set! xb (- b (* mphi(- b a))))
 40|                         (try a b xa ya xb (fun xb))
 41|                   )
 42|             );cond...
 43|        )
 44| )
 45|)
 46|(define (close-enough? x y)
 47|  (<(abs (- x y))tolerance))
 48|(define tolerance 1e-3)
 49|(define total-iterations 0)
 50|(define xmin 0)
 51|(set! xmin(golden-section-search a b))
 52|  (display"Interval=\t[")
 53|  (display a)
 54|  (display" , ")
 55|  (display b)
 56|  (display"]\n")
 57|  (display"Total number of iteranions=")
 58|total-iterations
 59|  (display"xmin=\t\t")
 60|xmin
 61|  (display"f(xmin)=\t")
 62|(fun xmin)
 63|
```

```
_________________
Code:
/*  MIP   */
#include "mlisp.h"
extern double a/*2*/;
        extern double b/*2*/;
        double fun/*3*/ (double x) ;
        double golden__section__search/*7*/ (double a, double b) ;
        double golden__start/*15*/ (double a, double b) ;
        extern double mphi/*24*/;
        double __MIP__try/*25*/ (double a, double b
        , double xa, double ya
        , double xb, double yb) ;
        bool close__enough_Q/*46*/ (double x, double y);
        extern double tolerance/*48*/;
        extern double total__iterations/*49*/;
        extern double xmin/*50*/;
        //_________________
double a/*2*/ = 2.;
        double b/*2*/ = 6.;
        double fun/*3*/ (double x) {
 x = (x - (21. / 22.));
        return
 (expt((x - 3.)
        , 4.)
         - expt(atan(x)
        , 3.)
         - 2.);
        }
```

```
double golden__section__search/*7*/ (double a, double b) {
 {
 double xmin( ((a < b)
        ? golden__start(a
         , b)

        : true
        ? golden__start(b
         , a)

        : _infinity) );
         newline();
         return xmin;
         }
}
double golden__start/*15*/ (double a, double b) {
 total__iterations = 0.;
         {
 double xa( (a + (mphi * (b - a))) ),
         xb( (b + (- (mphi * (b - a)))) );
         return __MIP__try(a
         , b
         , xa
         , fun(xa)
         , xb
         , fun(xb))
         ;
         }
}
double mphi/*24*/ = ((3. - sqrt(5.)) * (1. / 2e+0));
         double __MIP__try/*25*/ (double a, double b
         , double xa, double ya
         , double xb, double yb) {
 return
 (close__enough_Q(a, b)

        ? ((a + b) * 5e-1)
        : true
        ? display("+"),
         total__iterations = (total__iterations + 1.),
         ((ya < yb)
        ? b = xb,
         xb = xa,
         yb = ya,
         xa = (a + (mphi * (b - a))),
         __MIP__try(a
         , b
         , xa
         , fun(xa)
         , xb
         , yb)

        : true
        ? a = xa,
         xa = xb,
```

```
        ya = yb,
        xb = (b - (mphi * (b - a))),
        __MIP__try(a
        , b
        , xa
        , ya
        , xb
        , fun(xb))

       : _infinity)
       : _infinity);
        }
bool close__enough_Q/*46*/ (double x, double y){
 return
 (abs((x - y)) < tolerance);
        }
double tolerance/*48*/ = 1e-3;
        double total__iterations/*49*/ = 0.;
        double xmin/*50*/ = 0.;
        int main(){
 xmin = golden__section__search(a
        , b)
        ;
        display("Interval=\t[");
        display(a);
        display(" , ");
        display(b);
        display("]\n");
        display("Total number of iteranions=");
        display(total__iterations);
        newline();
        display("xmin=\t\t");
        display(xmin);
        newline();
        display("f(xmin)=\t");
        display(fun(xmin));
        newline();
        std::cin.get();
        return
 0;
        }

Code is saved to file golden21.cpp !
```

Распечатка файла golden21.cpp .

```
/* MIP  */
#include "mlisp.h"
extern double a/*2*/;
    extern double b/*2*/;
    double fun/*3*/ (double x) ;
    double golden__section__search/*7*/ (double a, double
 b) ;
    double golden__start/*15*/ (double a, double b) ;
    extern double mphi/*24*/;
    double __MIP__try/*25*/ (double a, double b
    , double xa, double ya
```

```
    , double xb, double yb) ;
    bool close__enough_Q/*46*/ (double x, double y);
    extern double tolerance/*48*/;
    extern double total__iterations/*49*/;
    extern double xmin/*50*/;
    //____________________
double a/*2*/ = 2.;
    double b/*2*/ = 6.;
    double fun/*3*/ (double x) {
 x = (x - (21. / 22.));
    return
 (expt((x - 3.)
    , 4.)
     - expt(atan(x)
    , 3.)
     - 2.);
    }
double golden__section__search/*7*/ (double a, double b)
{
 {
 double xmin( ((a < b)
   ? golden__start(a
    , b)

   : true
   ? golden__start(b
    , a)

   : _infinity) );
    newline();
    return xmin;
    }
}
double golden__start/*15*/ (double a, double b) {
 total__iterations = 0.;
    {
 double xa( (a + (mphi * (b - a))) ),
    xb( (b + (- (mphi * (b - a)))) );
    return __MIP__try(a
    , b
    , xa
    , fun(xa)
```

```
    , xb
    , fun(xb))
    ;
    }
}
double mphi/*24*/ = ((3. - sqrt(5.)) * (1. / 2e+0));
    double __MIP__try/*25*/ (double a, double b
    , double xa, double ya
    , double xb, double yb) {
 return
 (close__enough_Q(a, b)

   ? ((a + b) * 5e-1)
   : true
   ? display("+"),
    total__iterations = (total__iterations + 1.),
    ((ya < yb)
   ? b = xb,
    xb = xa,
    yb = ya,
    xa = (a + (mphi * (b - a))),
    __MIP__try(a
    , b
    , xa
    , fun(xa)
    , xb
    , yb)

   : true
   ? a = xa,
    xa = xb,
    ya = yb,
    xb = (b - (mphi * (b - a))),
    __MIP__try(a
    , b
    , xa
    , ya
    , xb
    , fun(xb))

   : _infinity)
   : _infinity);
```

```
    }
bool close__enough_Q/*46*/ (double x, double y){
 return
 (abs((x - y)) < tolerance);
    }
double tolerance/*48*/ = 1e-3;
    double total__iterations/*49*/ = 0.;
    double xmin/*50*/ = 0.;
    int main(){
 xmin = golden__section__search(a
    , b)
    ;
    display("Interval=\t[");
    display(a);
    display(" , ");
    display(b);
    display("]\n");
    display("Total number of iteranions=");
    display(total__iterations);
    newline();
    display("xmin=\t\t");
    display(xmin);
    newline();
    display("f(xmin)=\t");
    display(fun(xmin));
    newline();
    std::cin.get();
    return
 0;
    }
```

Скриншот запуска задачи на C++.

```
mosik@LAPTOP-69S778GL:~/sp_cw1$ ./golden21
++++++++++++++++++
Interval=       [2 , 6]
Total number of iteranions=18
xmin=           4.4128743917421 54
f(xmin)=        -4.099152034991492
```

Контрольная задача №3 – coin21.

Полный скриншот трансляции без трассировки.

```
Source>coin21
Source:coin21.ss
   1|;coin21.ss
   2|(define VARIANT 21)
   3|(define LAST-DIGIT-OF-GROUP-NUMBER 8)
   4|(define KINDS-OF-COINS 5)
   5|
   6|(define (first-denomination kinds-of-coins)
   7|  (cond((= kinds-of-coins 1) 1)
   8|       ((= kinds-of-coins 2) 3)
   9|       ((= kinds-of-coins 3) 10)
  10|       ((= kinds-of-coins 4) 20)
  11|       ((= kinds-of-coins 5) 50)
  12|       (#t 0)
  13|  )
  14|)
  15|
  16|(define (count-change amount)
  17|  (display "_____\n amount: ")
  18|  (display amount)
  19|  (newline)
  20|  (display "KINDS-OF-COINS: ")
  21|  (display KINDS-OF-COINS)
  22|  (newline)
  23|  (let(
  24|      (largest-coin (first-denomination KINDS-OF-COINS))
  25|      )
  26|    (display "largest-coin: ")
  27|    (display largest-coin)
  28|    (newline)
  29|    (cond((and (< 0 amount)(< 0 KINDS-OF-COINS)(< 0 largest-coin))
  30|          (display "List of coin denominations: ")
  31|            (denomination-list KINDS-OF-COINS)
  32|            (display "count-change= ")
  33|            (cc amount KINDS-OF-COINS)
  34|            )
  35|          (#t (display "Improper parameter value!\ncount-change= ") -1)
  36|    )
  37|  )
  38|)
  39|
  40|(define(NOT? x?)(= 0(cond(x? 1)(#t 0))))
  41|
  42|(define (pier? x? y?)
  43|  (NOT? (or x? y?))
  44|)
  45|
  46|(define (cc amount kinds-of-coins)
  47|  (cond((= amount 0) 1)
  48|       ((pier? (< amount 0)(= kinds-of-coins 0))
  49|        (+ (cc amount (- kinds-of-coins 1))
  50|           (cc (- amount (first-denomination kinds-of-coins)) kinds-of-coins))
  51|       )
  52|       (#t 0)
  53|  )
  54|)
  55|
```

```
(define (denomination-list kinds-of-coins)
  (cond((= kinds-of-coins 0) (newline) 0)
       (#t (display (first-denomination kinds-of-coins))
            (display " ")
            (denomination-list (- kinds-of-coins 1))
       )
  )
)

(define (GR-AMOUNT)
  (remainder (+ (* 100 LAST-DIGIT-OF-GROUP-NUMBER) VARIANT) 231)
)

(display "Variant ")
(display VARIANT)
(newline)
(newline)
(display (count-change 100)) (newline)
(display (count-change(GR-AMOUNT))) (newline)
(set! KINDS-OF-COINS 13)
(display (count-change 100)) (newline)
(display "(c) Moiseenkov I.P. 2021\n")
```

Code:

```
/*  MIP   */
#include "mlisp.h"
extern double VARIANT/*2*/;
        extern double LAST__DIGIT__OF__GROUP__NUMBER/*3*/;
        extern double KINDS__OF__COINS/*4*/;
        double first__denomination/*6*/ (double kinds__of__coins) ;
        double count__change/*16*/ (double amount) ;
        bool NOT_Q/*40*/ (double x_Q);
        bool pier_Q/*42*/ (double x_Q, double y_Q);
        double cc/*46*/ (double amount, double kinds__of__coins) ;
        double denomination__list/*56*/ (double kinds__of__coins) ;
        double GR__AMOUNT/*65*/ () ;
        //__________________
double VARIANT/*2*/ = 21.;
        double LAST__DIGIT__OF__GROUP__NUMBER/*3*/ = 8.;
        double KINDS__OF__COINS/*4*/ = 5.;
        double first__denomination/*6*/ (double kinds__of__coins) {
 return
 ((kinds__of__coins == 1.)
       ? 1.
       : (kinds__of__coins == 2.)
       ? 3.
       : (kinds__of__coins == 3.)
       ? 10.
       : (kinds__of__coins == 4.)
       ? 20.
       : (kinds__of__coins == 5.)
       ? 50.
       : true
       ? 0.
       : _infinity);
        }
```

```
double count__change/*16*/ (double amount) {
 display("______\n amount: ");
        display(amount);
        newline();
        display("KINDS-OF-COINS: ");
        display(KINDS__OF__COINS);
        newline();
        {
 double largest__coin( first__denomination(KINDS__OF__COINS) );
        display("largest-coin: ");
        display(largest__coin);
        newline();
        return (((0. < amount) && (0. < KINDS__OF__COINS) && (0. < largest__coin))
       ? display("List of coin denominations: "),
        denomination__list(KINDS__OF__COINS),
        display("count-change= "),
        cc(amount
        , KINDS__OF__COINS)

       : true
       ? display("Improper parameter value!\ncount-change= "),
        -1.
       : _infinity);
        }
}
bool NOT_Q/*40*/ (double x_Q){
 return
 (0. == (x_Q
       ? 1.
       : true
       ? 0.
       : _infinity));
        }
bool pier_Q/*42*/ (double x_Q, double y_Q){
 return
 NOT_Q((x_Q || y_Q));
        }
double cc/*46*/ (double amount, double kinds__of__coins) {
 return
 ((amount == 0.)
       ? 1.
       : pier_Q((amount < 0.), (kinds__of__coins == 0.))
       ? (cc(amount
        , (kinds__of__coins - 1.))
         + cc((amount - first__denomination(kinds__of__coins))
        , kinds__of__coins)
        )
       : true
       ? 0.
       : _infinity);
        }
double denomination__list/*56*/ (double kinds__of__coins) {
 return
 ((kinds__of__coins == 0.)
       ? newline(),
        0.
       : true
       ? display(first__denomination(kinds__of__coins)),
        display(" "),
        denomination__list((kinds__of__coins - 1.))
       : _infinity);
        }
```

```
double GR__AMOUNT/*65*/ () {
 return
 remainder(((100. * LAST__DIGIT__OF__GROUP__NUMBER) + VARIANT)
         , 231.)
         ;
         }
int main(){
 display("Variant ");
         display(VARIANT);
         newline();
         newline();
         display(count__change(100.));
         newline();
         display(count__change(GR__AMOUNT()));
         newline();
         KINDS__OF__COINS = 13.;
         display(count__change(100.));
         newline();
         display("(c) Moiseenkov I.P. 2021\n");
         std::cin.get();
         return
 0;
         }

Code is saved to file coin21.cpp !
```

Распечатка файла coin21.cpp .

```
/*  MIP  */
#include "mlisp.h"
extern double VARIANT/*2*/;
    extern double LAST__DIGIT__OF__GROUP__NUMBER/*3
*/;
    extern double KINDS__OF__COINS/*4*/;
    double first__denomination/*6*/ (double kinds__of__co
ins) ;
    double count__change/*16*/ (double amount) ;
    bool NOT_Q/*40*/ (double x_Q);
    bool pier_Q/*42*/ (double x_Q, double y_Q);
    double cc/*46*/ (double amount, double kinds__of__coi
ns) ;
    double denomination__list/*56*/ (double kinds__of__co
ins) ;
    double GR__AMOUNT/*65*/ () ;
    //____________________
double VARIANT/*2*/ = 21.;
    double LAST__DIGIT__OF__GROUP__NUMBER/*3*/ = 8.
;
    double KINDS__OF__COINS/*4*/ = 5.;
    double first__denomination/*6*/ (double kinds__of__co
ins) {
 return
```

```
 ((kinds__of__coins == 1.)
   ? 1.
   : (kinds__of__coins == 2.)
   ? 3.
   : (kinds__of__coins == 3.)
   ? 10.
   : (kinds__of__coins == 4.)
   ? 20.
   : (kinds__of__coins == 5.)
   ? 50.
   : true
   ? 0.
   : _infinity);
    }
double count__change/*16*/ (double amount) {
 display("_______\n amount: ");
    display(amount);
    newline();
    display("KINDS-OF-COINS: ");
    display(KINDS__OF__COINS);
    newline();
    {
 double largest__coin( first__denomination(KINDS__OF__C
OINS) );
    display("largest-coin: ");
    display(largest__coin);
    newline();
    return (((0. < amount) && (0. < KINDS__OF__COINS) &
& (0. < largest__coin))
   ? display("List of coin denominations: "),
    denomination__list(KINDS__OF__COINS),
    display("count-change= "),
    cc(amount
    , KINDS__OF__COINS)

   : true
   ? display("Improper parameter value!\ncount-
change= "),
    -1.
   : _infinity);
    }
}
```

```
bool NOT_Q/*40*/ (double x_Q){
 return
 (0. == (x_Q
    ? 1.
    : true
    ? 0.
    : _infinity));
     }
bool pier_Q/*42*/ (double x_Q, double y_Q){
 return
 NOT_Q((x_Q || y_Q));
     }
double cc/*46*/ (double amount, double kinds__of__coins)
 {
 return
 ((amount == 0.)
    ? 1.
    : pier_Q((amount < 0.), (kinds__of__coins == 0.))

    ? (cc(amount
     , (kinds__of__coins - 1.))
      + cc((amount - first__denomination(kinds__of__coins))
     , kinds__of__coins)
     )
    : true
    ? 0.
    : _infinity);
     }
double denomination__list/*56*/ (double kinds__of__coins
) {
 return
 ((kinds__of__coins == 0.)
    ? newline(),
     0.
    : true
    ? display(first__denomination(kinds__of__coins)),
     display(" "),
     denomination__list((kinds__of__coins - 1.))
    : _infinity);
     }
double GR__AMOUNT/*65*/ () {
 return
```

```
 remainder(((100. * LAST__DIGIT__OF__GROUP__NUMBER
) + VARIANT)
    , 231.)
    ;
    }
int main(){
 display("Variant ");
    display(VARIANT);
    newline();
    newline();
    display(count__change(100.));
    newline();
    display(count__change(GR__AMOUNT()));
    newline();
    KINDS__OF__COINS = 13.;
    display(count__change(100.));
    newline();
    display("(c) Moiseenkov I.P. 2021\n");
    std::cin.get();
    return
 0;
    }
```

Скриншот запуска задачи на C++.

```
mosik@LAPTOP-69S778GL:~/sp_cw1$ ./coin21
Variant 21

______
 amount: 100
KINDS-OF-COINS: 5
largest-coin: 50
List of coin denominations: 50 20 10 3 1
count-change= 525

______
 amount: 128
KINDS-OF-COINS: 5
largest-coin: 50
List of coin denominations: 50 20 10 3 1
count-change= 1095

______
 amount: 100
KINDS-OF-COINS: 13
largest-coin: 0
Improper parameter value!
count-change= -1
(c) Moiseenkov I.P. 2021
```

Распечатка файла code-gen.cpp.

```
/* $j21 */
#include "code-gen.h"
using namespace std;
void tCG::init(){declarations.clear();
   Authentication = "MIP";
}
int tCG::p01(){ // S -> PROG
   string header ="/*  " + Authentication +"   */\n";
   header += "#include \"mlisp.h\"\n";
   header += declarations;
   header += "//____________________ \n";
   S1->obj = header + S1->obj;
   return 0;
}
int tCG::p02(){ // PROG -> CALCS
   S1->obj = "int main(){\n " + S1->obj +
"std::cin.get();\n\t return\n 0;\n\t }\n";
  return 0;
}
int tCG::p03(){ // PROG -> DEFS
   S1->obj += "int main(){\n "
            "display(\"No calculations!\");\n\t newline();\n\t
"
            "std::cin.get();\n\t return\n 0;\n\t }\n";
  return 0;
}
int tCG::p04(){ // PROG -> DEFS CALCS
   S1->obj += "int main(){\n " + S2->obj +
"std::cin.get();\n\t return\n 0;\n\t }\n";
  return 0;
}
int tCG::p05(){ // E -> $id
   S1->obj = decor(S1->name);
  return 0;
}
int tCG::p06(){ // E -> $int
   S1->obj = S1->name + ".";
  return 0;
}
int tCG::p07(){ // E -> $dec
```

```
   S1->obj = S1->name;
  return 0;
}
int tCG::p08(){ // E -> AREX
  return 0;
}
int tCG::p09(){ // E -> COND
  return 0;
}
int tCG::p10(){ // E -> CPROC
  return 0;
}
int tCG::p11(){ // CPROC -> HCPROC )
   S1->obj += ")";
   if (S1->count >= 2) {
      S1->obj += "\n\t ";
   }
  return 0;
}
int tCG::p12(){ // HCPROC -> ( $id
   S1->obj = decor(S2->name) + "(";
  return 0;
}
int tCG::p13(){ // HCPROC -> HCPROC E
   if (S1->count) {
      S1->obj += "\n\t , ";
   }
   S1->obj += S2->obj;
   ++S1->count;
  return 0;
}
int tCG::p14(){ // AREX -> HAREX E )
   if (S1->name == "/" && S1->count == 0) {
      S1->obj = "(1. " + S1->obj + " " + S2->obj + ")";
   }
   else {
      S1->obj = "(" + S1->obj + " " + S2->obj + ")";
   }
  return 0;
}
int tCG::p15(){ // HAREX -> ( AROP
   S1->obj = S2->obj;
```

```
   S1->name = S2->name;
  return 0;
}
int tCG::p16(){ // HAREX -> HAREX E
   if (S1->count == 0)
      S1->obj = S2->obj + " " + S1->name;
   else
      S1->obj = S1->obj + " " + S2->obj + " " + S1->name;
   ++S1->count;
  return 0;
}
int tCG::p17(){ // AROP -> +
   S1->obj = S1->name;
  return 0;
}
int tCG::p18(){ // AROP -> -
   S1->obj = S1->name;
  return 0;
}
int tCG::p19(){ // AROP -> *
   S1->obj = S1->name;
  return 0;
}
int tCG::p20(){ // AROP -> /
   S1->obj = S1->name;
  return 0;
}
int tCG::p21(){ // COND -> ( cond BRANCHES )
   S1->obj = "(" + S3->obj + "_infinity)";
  return 0;
}
int tCG::p22(){ // BRANCHES -> CLAUS
  return 0;
}
int tCG::p23(){ // BRANCHES -> CLAUS BRANCHES
   S1->obj += S2->obj;
  return 0;
}
int tCG::p24(){ // CLAUS -> ( BOOL CLAUSB )
   S1->obj += S2->obj + "\n\t? " + S3->obj + "\n\t: ";
  return 0;
}
```

```
int tCG::p25(){ // CLAUSB -> E
  return 0;
}
int tCG::p26(){ // CLAUSB -> INTER CLAUSB
   S1->obj += ",\n\t " + S2->obj;
   ++S1->count;
   return 0;
}
int tCG::p27(){ // STR -> $str
   S1->obj = S1->name;
  return 0;
}
int tCG::p28(){ // STR -> SIF
  return 0;
}
int tCG::p29(){ // SIF -> ( if BOOL STR STR )
   S1->obj = "(" + S3->obj + "\n\t? " + S4->obj + "\n\t: "
+ S5->obj + ")";
  return 0;
}
int tCG::p30(){ // BOOL -> $bool
   S1->obj = (S1->name == "#t" ? "true" : "false");
  return 0;
}
int tCG::p31(){ // BOOL -> $idq
   S1->obj = decor(S1->name);
  return 0;
}
int tCG::p32(){ // BOOL -> REL
  return 0;
}
int tCG::p33(){ // BOOL -> OR
  return 0;
}
int tCG::p34(){ // BOOL -> AND
  return 0;
}
int tCG::p35(){ // BOOL -> CPRED
  return 0;
}
int tCG::p36(){ // CPRED -> HCPRED )
   S1->obj += ")";
```

```
   if (S1->count >= 2) {
      S1->obj += "\n\t ";
   }
  return 0;
}
int tCG::p37(){ // HCPRED -> ( $idq
   S1->obj = decor(S2->name) + "(";
  return 0;
}
int tCG::p38(){ // HCPRED -> HCPRED ARG
   if (S1->count) {
      S1->obj += S1->count % 2 ? ", " : "\n\t , ";
   }
   S1->obj += S2->obj;
   ++S1->count;
  return 0;
}
int tCG::p39(){ // ARG -> E
  return 0;
}
int tCG::p40(){ // ARG -> BOOL
  return 0;
}
int tCG::p41(){ // REL -> ( = E E )
   S1->obj = "(" + S3->obj + " == " + S4->obj + ")";
  return 0;
}
int tCG::p42(){ // REL -> ( < E E )
   S1->obj = "(" + S3->obj + " < " + S4->obj + ")";
  return 0;
}
int tCG::p43(){ // OR -> HOR BOOL )
   S1->obj = "(" + S1->obj + S2->obj + ")";
  return 0;
}
int tCG::p44(){ // HOR -> ( or
  return 0;
}
int tCG::p45(){ // HOR -> HOR BOOL
   S1->obj += S2->obj + " || ";
  return 0;
}
```

```
int tCG::p46(){ // AND -> HAND BOOL )
   S1->obj = "(" + S1->obj + S2->obj + ")";
  return 0;
}
int tCG::p47(){ // HAND -> ( and
  return 0;
}
int tCG::p48(){ // HAND -> HAND BOOL
   S1->obj += S2->obj + " && ";
  return 0;
}
int tCG::p49(){ // SET -> HSET E )
   S1->obj += S2->obj;
  return 0;
}
int tCG::p50(){ // HSET -> ( set! $id
   S1->obj = decor(S3->name) + " = ";
  return 0;
}
int tCG::p51(){ // DISPSET -> ( display E )
   S1->obj = "display(" + S3->obj + ")";
  return 0;
}
int tCG::p52(){ // DISPSET -> ( display BOOL )
   S1->obj = "display(" + S3->obj + ")";
  return 0;
}
int tCG::p53(){ // DISPSET -> ( display STR )
   S1->obj = "display(" + S3->obj + ")";
  return 0;
}
int tCG::p54(){ // DISPSET -> ( newline )
   S1->obj = "newline()";
  return 0;
}
int tCG::p55(){ // DISPSET -> SET
  return 0;
}
int tCG::p56(){ // INTER -> DISPSET
  return 0;
}
int tCG::p57(){ // INTER -> E
```

```
  return 0;
}
int tCG::p58(){ // CALCS -> CALC
  return 0;
}
int tCG::p59(){ // CALCS -> CALCS CALC
   S1->obj += S2->obj;
  return 0;
}
int tCG::p60(){ // CALC -> E
   S1->obj = "display(" + S1->obj + ");\n\t newline();\n\t
";
  return 0;
}
int tCG::p61(){ // CALC -> BOOL
   S1->obj = "display(" + S1->obj + ");\n\t newline();\n\t
";
  return 0;
}
int tCG::p62(){ // CALC -> STR
   S1->obj = "display(" + S1->obj + ");\n\t newline();\n\t
";
  return 0;
}
int tCG::p63(){ // CALC -> DISPSET
   S1->obj += ";\n\t ";
  return 0;
}
int tCG::p64(){ // DEFS -> DEF
  return 0;
}
int tCG::p65(){ // DEFS -> DEFS DEF
   S1->obj += S2->obj;
  return 0;
}
int tCG::p66(){ // DEF -> PRED
  return 0;
}
int tCG::p67(){ // DEF -> VAR
  return 0;
}
int tCG::p68(){ // DEF -> PROC
```

```
  return 0;
}
int tCG::p69(){ // PRED -> HPRED BOOL )
   S1->obj += "return\n " + S2->obj + ";\n\t }\n";
  return 0;
}
int tCG::p70(){ // HPRED -> PDPAR )
   S1->obj += ")";
   declarations += S1->obj + ";\n\t ";
   S1->obj += "{\n ";
  return 0;
}
int tCG::p71(){ // PDPAR -> ( define ( $idq
   S1->obj = "bool " + decor(S4->name) + "/*" + S4->line
+ "*/ (";
   S1->count = 0;
  return 0;
}
int tCG::p72(){ // PDPAR -> PDPAR $idq
   if (S1->count) {
      S1->obj += S1->count % 2 ? ", " : "\n\t , ";
   }
   S1->obj += "double " + decor(S2->name);
   ++S1->count;
  return 0;
}
int tCG::p73(){ // PDPAR -> PDPAR $id
   if (S1->count) {
      S1->obj += S1->count % 2 ? ", " : "\n\t , ";
   }
   S1->obj += "double " + decor(S2->name);
   ++S1->count;
  return 0;
}
int tCG::p74(){ // VAR -> VARDCL E )
   declarations += "extern double " + S1->obj + "/*" + S1-
>line + "*/;\n\t ";
   S1->obj = "double " + S1->obj + "/*" + S1->line + "*/ =
" + S2->obj + ";\n\t ";
  return 0;
}
int tCG::p75(){ // VARDCL -> ( define $id
```

```
   S1->obj = decor(S3->name);
  return 0;
}
int tCG::p76(){ // PROC -> HPROC BLOCK )
   S1->obj += S2->obj + "}\n";
  return 0;
}
int tCG::p77(){ // PROC -> HPROC E )
   S1->obj += "return\n " + S2->obj + ";\n\t }\n";
  return 0;
}
int tCG::p78(){ // HPROC -> PCPAR )
   S1->obj += ") ";
   declarations += S1->obj + ";\n\t ";
   S1->obj += "{\n ";
  return 0;
}
int tCG::p79(){ // HPROC -> HPROC INTER
   S1->obj += S2->obj + ";\n\t ";
  return 0;
}
int tCG::p80(){ // PCPAR -> ( define ( $id
   S1->obj = "double " + decor(S4->name) + "/*" + S4-
>line + "*/ (";
   S1->count = 0;
   S1->name = S4->name;
  return 0;
}
int tCG::p81(){ // PCPAR -> PCPAR $id
   if (S1->count) {
      S1->obj += S1->count % 2 ? ", " : "\n\t , ";
   }
   S1->obj += "double " + decor(S2->name);
   ++S1->count;
  return 0;
}
int tCG::p82(){ // BLOCK -> HBLOCK E )
   S1->obj += "return " + S2->obj +";\n\t }\n";
  return 0;
}
int tCG::p83(){ // HBLOCK -> BLVAR )
   S1->obj += ";\n\t ";
```

```
  return 0;
}
int tCG::p84(){ // HBLOCK -> HBLOCK INTER
   S1->obj += S2->obj + ";\n\t ";
  return 0;
}
int tCG::p85(){ // BLVAR -> ( let ( LOCDEF
   S1->obj += "{\n double " + S4->obj;
  return 0;
}
int tCG::p86(){ // BLVAR -> BLVAR LOCDEF
   S1->obj += ",\n\t " + S2->obj;
  return 0;
}
int tCG::p87(){ // LOCDEF -> ( $id E )
   S1->obj += decor(S2->name) + "( " + S3->obj + " )";
  return 0;
}
//_____________________________
int tCG::p88(){return 0;} int tCG::p89(){return 0;}
int tCG::p90(){return 0;} int tCG::p91(){return 0;}
int tCG::p92(){return 0;} int tCG::p93(){return 0;}
int tCG::p94(){return 0;} int tCG::p95(){return 0;}
int tCG::p96(){return 0;} int tCG::p97(){return 0;}
int tCG::p98(){return 0;} int tCG::p99(){return 0;}
int tCG::p100(){return 0;} int tCG::p101(){return 0;}
int tCG::p102(){return 0;} int tCG::p103(){return 0;}
int tCG::p104(){return 0;} int tCG::p105(){return 0;}
int tCG::p106(){return 0;} int tCG::p107(){return 0;}
int tCG::p108(){return 0;} int tCG::p109(){return 0;}
int tCG::p110(){return 0;}
```