File created: 1-Aug-88 11:37:03 **{DSK}<LISPFILES>LOGIC>MEDLEY>UNIFIER.;1**

previous date: 13-Jul-88 15:26:58 {DSK}<LISPFILES>LOGIC>UNIFIER.;1

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```
(IL:RPAQQ IL:UNIFIERCOMS ((IL:FUNCTIONS BINDING BUILD-NEW-ENV CREATE-NEW-VARIABLE CREATE-VARIABLES
                                 FIND-IF-MEMBER FIND-VALUES FIND-VARIABLE-VALUE LOOKUP NULLP RENAME RENAME-VARS
                                 UNIFY VARIABLEP)))

(DEFUN BINDING (PREDICATE THEORY-NAME &OPTIONAL WINDOW)
   [COND
      [(EQ THEORY-NAME '*BACKGROUND-THEORY*)
       (COND
          [(EQ (CHAR-CODE (CHAR (SYMBOL-NAME PREDICATE)
                                0))
               33)

           ;; CUT is handled in a very particular way!!

           (GETHASH '! (GET 'THEORY '*BACKGROUND-THEORY*]
          (T (GETHASH PREDICATE (GET 'THEORY '*BACKGROUND-THEORY*]
      (T (GETHASH PREDICATE (GET-THEORY THEORY-NAME WINDOW])

(DEFUN BUILD-NEW-ENV (PAT DAT ENV)

   ;;  It is better to make a distinction between the null value of a variable  and the variables unbound

   (COND
      ((NULL DAT)
       (ACONS PAT '*NULL* ENV))
      (T (ACONS PAT DAT ENV))))

(DEFUN CREATE-NEW-VARIABLE ()
   [PROGN (SETF *VARIABLES-COUNTER* (+ 1 *VARIABLES-COUNTER*))
          (OR (GETHASH *VARIABLES-COUNTER* *VARIABLES-TABLE*)
              (SETF (GETHASH *VARIABLES-COUNTER* *VARIABLES-TABLE*)
                    (MAKE-SYMBOL (FORMAT NIL "?~A" *VARIABLES-COUNTER*])

(DEFUN CREATE-VARIABLES ()
   (DEFVAR *VARIABLES-TABLE* (MAKE-HASH-TABLE))

   ;; all the variables used are cached in a hash-table: this is also for not generating a lot of symbols that will fill up the symbol table of the system

   ;; This function must be called before starting to work with Logic

   (DO ((X 0 (+ X 1)))
       ((= X 4095)
        T)
     (SETF (GETHASH X *VARIABLES-TABLE*)
           (MAKE-SYMBOL (FORMAT NIL "?~A" X)))))

(DEFUN FIND-IF-MEMBER (ELT LST)
   (COND
      ((NULL LST)
       NIL)
      [(LISTP LST)
       (OR (FIND-IF-MEMBER ELT (CAR LST))
           (FIND-IF-MEMBER ELT (CDR LST]
      ((ATOM LST)
       (EQ LST ELT))
      (T (MEMBER ELT LST))))

(DEFUN FIND-VALUES (ELT ENV)
   (COND
      ((NULL ELT)
       NIL)
      ((LISTP ELT)
       (CONS (FIND-VALUES (CAR ELT)
                    ENV)
             (FIND-VALUES (CDR ELT)
                    ENV)))
      ((VARIABLEP ELT)
       (FIND-VARIABLE-VALUE ELT ENV))
      (T ELT)))
```

```
(DEFUN FIND-VARIABLE-VALUE (VAR ENV)
   [LET [(VAL (CDR (ASSOC VAR ENV]
        (COND
           ((VARIABLEP VAL)
            (FIND-VARIABLE-VALUE VAL ENV))
           ((NULL VAL)

            ;; The variable is unbound, so the variable itself is returned

            VAR)
           ((NULLP VAL)

            ;; NULLP checks is the value is *NULL*

            NIL)
           (T ;; This is the statement for a partial occur  check

              (OR (AND (NOT (FIND-IF-MEMBER VAR VAL))
                       (FIND-VALUES VAL ENV))
                  VAL])


(DEFUN LOOKUP (EXPR ENV)
   [COND
      ((NUMBERP EXPR)
       EXPR)
      ((SYMBOLP EXPR)
       (FIND-VALUES EXPR ENV))
      (T (CONS (FIND-VALUES (CAR EXPR)
                      ENV)
               (FIND-VALUES (CDR EXPR)
                      ENV])


(DEFMACRO NULLP (ATOM)
   `(EQ ,ATOM '*NULL*))


(DEFUN RENAME (EXPR)
   (LET ((VARSTABLE (MAKE-HASH-TABLE)))
        (DECLARE (SPECIAL VARSTABLE))
        (RENAME-VARS EXPR)))


(DEFUN RENAME-VARS (EXPR)
   (COND
      ((NULL EXPR)
       NIL)
      [(LISTP EXPR)
       (CONS (RENAME-VARS (CAR EXPR))
             (RENAME-VARS (CDR EXPR]
      [(VARIABLEP EXPR)
       (LET ((ALREADY-RENAMED (GETHASH EXPR VARSTABLE)))
            (COND
               (ALREADY-RENAMED ALREADY-RENAMED)
               (T (LET ((NEW (CREATE-NEW-VARIABLE)))
                       (SETF (GETHASH EXPR VARSTABLE)
                             NEW)
                       NEW]
      (T EXPR)))


(DEFUN UNIFY (PATT DAT ENV &OPTIONAL WINDOW)

   ;; This is a very fast implementation of unifier: no stack frames are generated. The tecnique used here is that of save-rest argument: the unifier is not
   ;; a true-recursive procedure, in the sense that it does not require a full stack for its implementation: in fact, when failure occurs, the value FAILED
   ;; must be immediately returned

   [PROG ([DEBUGFLG (AND WINDOW (TRACINGP WINDOW 'UNIFY]
          (REST-PAT)
          (REST-DAT)
          TEMP)
     HERE
         (AND DEBUGFLG (UNIFY-DEBUGGER PATT DAT ENV WINDOW))       ; debugging stuff
         [COND
            [(AND (NULL PATT)
                  (NULL DAT))
             (COND
                ((AND (NULL REST-DAT)
                      REST-PAT)
                 (RETURN 'FAILED))
                ((AND (NULL REST-PAT)
                      REST-DAT)
                 (RETURN 'FAILED))
                ((AND (NULL REST-PAT)
                      (NULL REST-DAT))
                 (RETURN ENV))
                (T (SETF PATT (CAR REST-PAT))
                   (SETF DAT (CAR REST-DAT))
                   (SETF REST-PAT (CDR REST-PAT))
```

```
                    (SETF REST-DAT (CDR REST-DAT))
                    (GO HERE]
             ((EQ ENV 'FAILED)
              (RETURN 'FAILED))
             ((EQ PATT DAT)
              (GO OUT))
             [(VARIABLEP DAT)
              (SETF TEMP (CDR (ASSOC DAT ENV)))
              (COND
                 ((NULL TEMP)
                  (SETF ENV (BUILD-NEW-ENV DAT PATT ENV))
                  (GO OUT))
                 (T (SETF DAT TEMP)
                    (GO HERE]
             [(VARIABLEP PATT)
              (SETF TEMP (CDR (ASSOC PATT ENV)))
              (COND
                 ((NULL TEMP)
                  (SETF ENV (BUILD-NEW-ENV PATT DAT ENV))
                  (GO OUT))
                 (T (SETF PATT TEMP)
                    (GO HERE]
             [(NULL PATT)
              (COND
                 ((NULLP DAT)
                  (GO OUT))
                 (T (RETURN 'FAILED]
             [(NULL DAT)
              (COND
                 ((NULLP PATT)
                  (GO OUT))
                 (T (RETURN 'FAILED]
             [(LISTP PATT)
              (COND
                 ((LISTP DAT)
                  (SETF REST-PAT (CONS (REST PATT)
                                       REST-PAT))
                  (SETF REST-DAT (CONS (REST DAT)
                                       REST-DAT))
                  (SETF PATT (CAR PATT))
                  (SETF DAT (CAR DAT))
                  (GO HERE))
                 (T (RETURN 'FAILED]
             (T (RETURN 'FAILED]
      OUT
```

;; a check is made for the end of the procedure

```
          (COND
             ((AND (NULL REST-PAT)
                   (NULL REST-DAT))
              (RETURN ENV))
             (T (SETF DAT NIL)
                (SETF PATT NIL)
                (GO HERE])


(DEFMACRO VARIABLEP (ITEM)
   `(AND (SYMBOLP ,ITEM)
         (EQ (CHAR-CODE (CHAR (SYMBOL-NAME ,ITEM)
                              0))
             63)))

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{MEDLEY}<lispusers>UNIFIER.;1   28-Jun-2024 18:34:03
-- Listed on 30-Jun-2024 13:15:06 --

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