

File created: 3-May-88 11:52:41 {ERINYES}<LISPUSERS>MEDLEY>MAKEGRAPH.;1

previous date: 10-Jul-85 19:33:14 {ERINYES}<LISP>KOTO>LISPUSERS>MAKEGRAPH.;1

Read Table: INTERLISP

Package: INTERLISP

Format: XCCS

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(RPAQQ MAKEGRAPHCOMS

```
((FNS MAKE.GRAPH MAKE.GRAPH.ACCESS MAKE.GRAPH.ACCESS.NODES MAKE.GRAPH.ALREADY.SENP MAKE.GRAPH.CONSTRUCT
MAKE.GRAPH.CONSTRUCT.BELOW MAKE.GRAPH.DATUM MAKE.GRAPH.EXAMPLE.1 MAKE.GRAPH.EXAMPLE.2
MAKE.GRAPH.FATHER MAKE.GRAPH.FIND.ROOTS MAKE.GRAPH.FIND.ROOTS.BELOW
MAKE.GRAPH.INTERNAL.LEFTBUTTONFN MAKE.GRAPH.INTERNAL.MIDDLEBUTTONFN MAKE.GRAPH.INTERNAL.TITLE.FN
MAKE.GRAPH.INTERNAL.TITLE.FN.MENU MAKE.GRAPH.LABEL MAKE.GRAPH.LEFTBUTTONFN MAKE.GRAPH.MAKE.SUBGRAPH
MAKE.GRAPH.MIDDLEBUTTONFN MAKE.GRAPH.MIDDLEBUTTONFN.MENU MAKE.GRAPH.NODE.ALREADY.SENP
MAKE.GRAPH.NODE.SONS MAKE.GRAPH.NODE.SPECS.LABEL MAKE.GRAPH.NODE.SPECS.SONS MAKE.GRAPH.PROP.PAIRS
MAKE.GRAPH.SHOW.LIST MAKE.GRAPH.SHOW.SPEC MAKE.GRAPH.NODE.TYPE MAKE.GRAPH.STATE
MAKE.GRAPH.UPDATE.WINDOW)
(FILE (FROM VALUEOF LISPUSERSDIRECTORIES)
GRAPHER)
(VARS (MAKE.GRAPH.INTERNAL.TITLE.FN.MENU)
MAKE.GRAPH.LIST.SPEC
(MAKE.GRAPH.MIDDLEBUTTONFN.MENU)
MAKE.GRAPH.SPEC.SPEC))
```

(DEFINEQ

(MAKE.GRAPH

```
[LAMBDA (WINDOW TITLE GRAPH.SPECIFICATION ROOTS CONTEXT LEFTBUTTONFN MIDDLEBUTTONFN TOPJUSTIFYFLG DEPTH)
(* DAHJr "6-MAY-83 18:45")
```

(* CREATES A GRAPHER WINDOW STARTING FROM ROOTS ACCORDING TO GRAPH.SPECIFICATION)

(* GRAPH.SPECIFICATION%: A PLIST OF STATES WHOSE VALUES ARE ACTIONS)

(* ACTION%: A PLIST WITH PROPERTIES%: (LABEL LABEL.SPEC)
(FONT FONT.SPEC) (SONS (SONS.SPEC STATE.SPEC)) (ROOTS
(ROOTS.SPEC STATE.SPEC)))

(* x.SPEC%: FORM TO BE EVAL'D IN AN ENVIRONMENT WHERE DATUM AND CONTEXT ARE BOUND)

(* ROOTS%: ((DATUM % STATE) |...| (DATUM % STATE)))

```
(PROG (TTL GRAPH NEW.WINDOW LBF MBF)
(SETQ LBF (OR LEFTBUTTONFN (FUNCTION MAKE.GRAPH.LEFTBUTTONFN)))
(SETQ MBF (OR MIDDLEBUTTONFN (FUNCTION MAKE.GRAPH.MIDDLEBUTTONFN)))
(SETQ TTL (OR TITLE "A graph")))
(SETQ GRAPH (MAKE.GRAPH.CONSTRUCT GRAPH.SPECIFICATION ROOTS CONTEXT DEPTH))
(SETQ NEW.WINDOW (SHOWGRAPH GRAPH WINDOW (FUNCTION MAKE.GRAPH.INTERNAL.LEFTBUTTONFN)
(FUNCTION MAKE.GRAPH.INTERNAL.MIDDLEBUTTONFN)
TOPJUSTIFYFLG))
(WINDOWPROP NEW.WINDOW 'TITLE TITLE)
(WINDOWPROP NEW.WINDOW 'GRAPH.SPECIFICATION GRAPH.SPECIFICATION)
(WINDOWPROP NEW.WINDOW 'ROOTS ROOTS)
(WINDOWPROP NEW.WINDOW 'CONTEXT CONTEXT)
(WINDOWPROP NEW.WINDOW 'LEFTBUTTONFN LBF)
(WINDOWPROP NEW.WINDOW 'MIDDLEBUTTONFN MBF)
(WINDOWPROP NEW.WINDOW 'TOPJUSTIFYFLG TOPJUSTIFYFLG)
(WINDOWPROP NEW.WINDOW 'DEPTH DEPTH)
(RETURN NEW.WINDOW))
```

(MAKE.GRAPH.ACCESS

```
[LAMBDA (DATUM ACCESS.SPEC CONTEXT)
(EVAL ACCESS.SPEC)]
```

(* edited%: "7-MAR-83 15:08")

(MAKE.GRAPH.ACCESS.NODES

```
[LAMBDA (NODES.SPECS DATUM CONTEXT)
(PROG (DATUM.SPEC STATE.SPEC NEW.NODES NEW.DATUM)
(SETQ DATUM.SPEC (CAR NODES.SPECS))
(SETQ STATE.SPEC (CADR NODES.SPECS))
(RETURN (SELECTQ DATUM.SPEC
```

(* DAHJr "10-MAR-83 09:50")

```
(EVAL (EVAL STATE.SPEC))
(LIST (for SUB.SPEC in (CDR NODES.SPECS) collect (SETQ NEW.DATUM (MAKE.GRAPH.ACCESS
DATUM
(CAR SUB.SPEC)
CONTEXT))
(CONS NEW.DATUM (MAKE.GRAPH.ACCESS
NEW.DATUM
(CADR SUB.SPEC)
```

```

(CONTEXT))))
(UNION (for SUB.SPEC in (CDR NODES.SPECS) join (MAKE.GRAPH.ACCESS.NODES SUB.SPEC DATUM
CONTEXT)))
(TRACE (SETQ NEW.NODES (MAKE.GRAPH.ACCESS.NODES (CADR NODES.SPECS)
DATUM CONTEXT))
(INspect NEW.NODES)
NEW.NODES)
(for NEW.DATUM in (MAKE.GRAPH.ACCESS DATUM DATUM.SPEC CONTEXT)
collect (CONS NEW.DATUM (MAKE.GRAPH.ACCESS NEW.DATUM STATE.SPEC CONTEXT]))

```

(MAKE.GRAPH.ALREADY.SEENP

```

[LAMBDA (NODE GRAPHNODES) (* DAHJr " 7-MAR-83 14:03")
(for GRAPHNODE in GRAPHNODES bind ID thereis (SETQ ID (fetch (GRAPHNODE NODEID) of GRAPHNODE))
(AND (EQ (CAR NODE)
(CAR ID))
(EQ (CDR NODE)
(CDR ID]))

```

(MAKE.GRAPH.CONSTRUCT

```

[LAMBDA (GRAPH.SPECIFICATION INITIAL.ROOTS CONTEXT DEPTH) (* DAHJr " 6-MAY-83 18:16")
(PROG ((GRAPHNODES (CONS)
(ROOTS (CONS))
IROOTS ROOT)
(SETQ IROOTS (APPEND INITIAL.ROOTS))
(until (NULL IROOTS) do (SETQ ROOT (CAR IROOTS))
(COND
((NOT (MAKE.GRAPH.ALREADY.SEENP ROOT (CAR GRAPHNODES)))
(TCONC ROOTS ROOT)
(MAKE.GRAPH.CONSTRUCT.BELOW ROOT CONTEXT GRAPH.SPECIFICATION GRAPHNODES
IROOTS DEPTH)))
(SETQ IROOTS (CDR IROOTS)))
(RETURN (LAYOUTLATTICE (CAR GRAPHNODES)
(DREVERSE (CAR ROOTS]))

```

(MAKE.GRAPH.CONSTRUCT.BELOW

```

[LAMBDA (NODE CONTEXT GRAPH.SPECIFICATION GRAPHNODES ROOTS DEPTH) (* rdh%: "10-Jul-85 19:31")
(PROG (ALREADY.SEEN DATUM NODE.TYPE NODE.TYPE.DESCRPTION GRAPHNODE LABEL.SPEC LABEL FONT.SPEC FONT
REFERENCE SONS SONS.SPEC SON.REFERENCES ROOTS.SPEC)
(SETQ DATUM (CAR NODE))
(SETQ NODE.TYPE (CDR NODE))
(SETQ NODE.TYPE.DESCRPTION (LISTGET GRAPH.SPECIFICATION NODE.TYPE))
(OR NODE.TYPE.DESCRPTION (ERROR NODE.TYPE "unrecognized state"))
(SETQ ALREADY.SEEN (MAKE.GRAPH.ALREADY.SEENP NODE (CAR GRAPHNODES)))
(SETQ REFERENCE (COND
(ALREADY.SEEN (CONS (CAR NODE)
(CDR NODE)))
(T NODE)))
(SETQ LABEL.SPEC (LISTGET NODE.TYPE.DESCRPTION 'LABEL))
(SETQ LABEL (COND
(LABEL.SPEC (MAKE.GRAPH.ACCESS DATUM LABEL.SPEC CONTEXT))
(T "???"))
(SETQ FONT.SPEC (LISTGET NODE.TYPE.DESCRPTION 'FONT))
(SETQ FONT (COND
(FONT.SPEC (MAKE.GRAPH.ACCESS DATUM FONT.SPEC CONTEXT))
(T NIL)))
(SETQ GRAPHNODE (create GRAPHNODE
NODEID _ REFERENCE
NODELABEL _ LABEL
NODEFONT _ FONT))
(TCONC GRAPHNODES GRAPHNODE)
[COND
(ALREADY.SEEN (replace (GRAPHNODE NODEBORDER) of GRAPHNODE with T))
((ZEROP DEPTH))
(T (SETQ SONS.SPEC (LISTGET NODE.TYPE.DESCRPTION 'SONS))
[COND
(SONS.SPEC (SETQ SONS (MAKE.GRAPH.ACCESS.NODES SONS.SPEC DATUM CONTEXT))
[SETQ SON.REFERENCES (for SON in SONS collect (MAKE.GRAPH.CONSTRUCT.BELOW
SON CONTEXT GRAPH.SPECIFICATION GRAPHNODES
ROOTS (COND
(NUMBERP DEPTH)
(SUB1 DEPTH)
(replace (GRAPHNODE TONODES) of GRAPHNODE with (DREVERSE SON.REFERENCES)
(SETQ ROOTS.SPEC (LISTGET NODE.TYPE.DESCRPTION 'ROOTS))
(COND
(ROOTS.SPEC (NCONC ROOTS (MAKE.GRAPH.ACCESS.NODES ROOTS.SPEC DATUM CONTEXT)
(RETURN REFERENCE]]

```

(MAKE.GRAPH.DATUM

```

[LAMBDA (NODE)
(CAR (fetch (GRAPHNODE NODEID) of NODE))

```

(MAKE.GRAPH.EXAMPLE.1

```
[LAMBDA NIL
  (MAKE.GRAPH.SHOW.SPEC MAKE.GRAPH.SPEC.SPEC)]
```

(* DAHJr " 6-MAY-83 18:50")

(MAKE.GRAPH.EXAMPLE.2

```
[LAMBDA (DEPTH)
  (MAKE.GRAPH.SHOW.LIST MAKE.GRAPH.LIST.SPEC DEPTH)]
```

(* DAHJr " 6-MAY-83 18:51")

(MAKE.GRAPH.FATHER

```
[LAMBDA (NODE WINDOW)
  (PROG (GRAPH GRAPHNODES FATHERS ID)
    (SETQ GRAPH (WINDOWPROP WINDOW 'GRAPH))
    (SETQ GRAPHNODES (fetch (GRAPH GRAPHNODES) of GRAPH))
    (SETQ FATHERS (fetch (GRAPHNODE FROMNODES) of NODE))
    (RETURN (COND
      (FATHERS (SETQ ID (CAR FATHERS))
        (for GRAPHNODE in GRAPHNODES thereis (EQ (fetch (GRAPHNODE NODEID) of GRAPHNODE
          ID)))
      (T NIL)))
```

(* DAHJr " 8-MAR-83 19:03")

(MAKE.GRAPH.FIND.ROOTS

```
[LAMBDA (GRAPH.SPECIFICATION INITIAL.ROOTS CONTEXT DEPTH)
  (PROG ((NODES (CONS))
    (NON-ROOTS (CONS))
    IROOTS ROOT)
    (SETQ IROOTS (APPEND INITIAL.ROOTS))
    (until (NULL IROOTS) do (SETQ ROOT (CAR IROOTS))
      (MAKE.GRAPH.FIND.ROOTS.BELOW ROOT CONTEXT GRAPH.SPECIFICATION NODES IROOTS
        NON-ROOTS DEPTH)
      (SETQ IROOTS (CDR IROOTS)))
    (RETURN (LDIFFERENCE (CAR NODES)
      (CAR NON-ROOTS]))
```

(* DAHJr " 6-MAY-83 18:18")

(MAKE.GRAPH.FIND.ROOTS.BELOW

```
[LAMBDA (NODE CONTEXT GRAPH.SPECIFICATION NODES ROOTS NON-ROOTS DEPTH)
  (PROG (DATUM STATE STATE.DESCRPTION REFERENCE SONS SONS.SPEC SON.REFERENCES ROOTS.SPEC)
    (SETQ DATUM (CAR NODE))
    (SETQ STATE (CDR NODE))
    (SETQ STATE.DESCRPTION (LISTGET GRAPH.SPECIFICATION STATE))
    (OR STATE.DESCRPTION (ERROR STATE "unrecognized state"))
    [COND
      ((MAKE.GRAPH.NODE.ALREADY.SEENP NODE (CAR NODES)))
      ((ZEROP DEPTH))
      (T (TCONC NODES NODE)
        (SETQ SONS.SPEC (LISTGET STATE.DESCRPTION 'SONS))
        [COND
          (SONS.SPEC (SETQ SONS (MAKE.GRAPH.ACCESS.NODES SONS.SPEC DATUM CONTEXT))
            (for SON in SONS collect (MAKE.GRAPH.FIND.ROOTS.BELOW SON CONTEXT GRAPH.SPECIFICATION
              NODES ROOTS NON-ROOTS (COND
                ((NUMBERP DEPTH)
                  (SUB1 DEPTH))
                (T (NUMBERP DEPTH))))
            (SETQ ROOTS.SPEC (LISTGET STATE.DESCRPTION 'ROOTS))
            (COND
              (ROOTS.SPEC (NCONC ROOTS (MAKE.GRAPH.ACCESS.NODES ROOTS.SPEC DATUM CONTEXT))
                (RETURN]))
```

(* DAHJr " 6-MAY-83 18:18")

(MAKE.GRAPH.INTERNAL.LEFTBUTTONFN

```
[LAMBDA (NODE WINDOW)
  (PROG (X Y REG FN)
    (SETQ X (LASTMOUSEX WINDOW))
    (SETQ Y (LASTMOUSEY WINDOW))
    [SETQ REG (DSPCLIPPINGREGION NIL (WINDOWPROP WINDOW 'DSP)]
    (RETURN (COND
      ((INSIDEP REG X Y)
        (APPLY* (WINDOWPROP WINDOW 'LEFTBUTTONFN)
          NODE WINDOW))
      (T (SETQ FN (WINDOWPROP WINDOW 'TITLE.LEFTBUTTONFN))
        (COND
          (FN (APPLY* FN WINDOW))
          (T (MAKE.GRAPH.INTERNAL.TITLE.FN WINDOW))
```

(* DAHJr " 9-MAR-83 12:02")

(MAKE.GRAPH.INTERNAL.MIDDLEBUTTONFN

```
[LAMBDA (NODE WINDOW)
  (PROG (X Y REG FN)
    (SETQ X (LASTMOUSEX WINDOW))
    (SETQ Y (LASTMOUSEY WINDOW))
    [SETQ REG (DSPCLIPPINGREGION NIL (WINDOWPROP WINDOW 'DSP)]
    (RETURN (COND
      ((INSIDEP REG X Y)
```

(* DAHJr " 9-MAR-83 12:02")

```

(APPLY* (WINDOWPROP WINDOW 'MIDDLEBUTTONFN)
        NODE WINDOW))
(T (SETQ FN (WINDOWPROP WINDOW 'TITLE.MIDDLEBUTTONFN))
  (COND
   (FN (APPLY* FN WINDOW))
   (T (MAKE.GRAPH.INTERNAL.TITLE.FN WINDOW])))

```

(MAKE.GRAPH.INTERNAL.TITLE.FN

(* DAHJr "6-MAY-83 18:25")

```

[LAMBDA (WINDOW)
  (PROG (COMMAND.MENU COMMAND)
        (SETQ COMMAND.MENU (MAKE.GRAPH.INTERNAL.TITLE.FN.MENU))
        (SETQ COMMAND (MENU COMMAND.MENU))
        (SELECTQ COMMAND
         (NIL NIL)
         (UPDATE (MAKE.GRAPH.UPDATE.WINDOW WINDOW))
         (SHOW.GRAPH.SPEC
          (MAKE.GRAPH.SHOW.SPEC (WINDOWPROP WINDOW 'GRAPH.SPECIFICATION))))
        (ERROR]))

```

(MAKE.GRAPH.INTERNAL.TITLE.FN.MENU

(* DAHJr "6-MAY-83 18:24")

```

[LAMBDA NIL
  (OR MAKE.GRAPH.INTERNAL.TITLE.FN.MENU (SETQ MAKE.GRAPH.INTERNAL.TITLE.FN.MENU
                                             (create MENU
                                              ITEMS _ ' (UPDATE SHOW.GRAPH.SPEC)
                                              CENTERFLG _ T
                                              CHANGEOFFSETFLG _ T)))]

```

(MAKE.GRAPH.LABEL

(* DAHJr "8-MAR-83 18:43")

```

[LAMBDA (GRAPHNODE)
  (fetch (GRAPHNODE NODELABEL) of GRAPHNODE)]

```

(MAKE.GRAPH.LEFTBUTTONFN

(* DAHJr "29-MAR-83 18:03")

```

[LAMBDA (GRAPHNODE WINDOW)
  (COND
   (GRAPHNODE (COND
                ((KEYDOWNP 'LSHIFT)
                 (printout PROMPTWINDOW T "Left button selection:" T " Node label: " (MAKE.GRAPH.LABEL
                                                                                       GRAPHNODE)
                                     T " Node state: " (MAKE.GRAPH.STATE GRAPHNODE))))
                (T (PROG (POSITION CR CX CY DX DY)
                        (SETQ POSITION (fetch (GRAPHNODE NODEPOSITION) of GRAPHNODE))
                        [SETQ CR (DSPCLIPPINGREGION NIL (WINDOWPROP WINDOW 'DSP)
                                (SETQ CX (IPLUS (fetch (REGION LEFT) of CR)
                                                (IQUOTIENT (fetch (REGION WIDTH) of CR)
                                                           2)))
                                (SETQ CY (IPLUS (fetch (REGION BOTTOM) of CR)
                                                (IQUOTIENT (fetch (REGION HEIGHT) of CR)
                                                           2)))
                                (SETQ DX (IDIFFERENCE CX (fetch (POSITION XCOORD) of POSITION)))
                                (SETQ DY (IDIFFERENCE CY (fetch (POSITION YCOORD) of POSITION)))
                                (SCROLLBYREPAINTFN WINDOW DX DY)])))])))]

```

(MAKE.GRAPH.MAKE.SUBGRAPH

(* DAHJr "25-JUN-83 16:26")

```

[LAMBDA (GRAPHNODE WINDOW)
  (MAKE.GRAPH NIL (CONCAT (WINDOWPROP WINDOW 'TITLE)
                          " >")
              (WINDOWPROP WINDOW 'GRAPH.SPECIFICATION)
              (LIST (CONS (MAKE.GRAPH.DATUM GRAPHNODE)
                          (MAKE.GRAPH.STATE GRAPHNODE)))
              (WINDOWPROP WINDOW 'CONTEXT)
              (WINDOWPROP WINDOW 'LEFTBUTTONFN)
              (WINDOWPROP WINDOW 'MIDDLEBUTTONFN)
              (WINDOWPROP WINDOW 'TOPJUSTIFYFLG)
              (WINDOWPROP WINDOW 'DEPTH))]

```

(MAKE.GRAPH.MIDDLEBUTTONFN

(* DAHJr "25-JUN-83 16:27")

```

[LAMBDA (GRAPHNODE WINDOW)
  (COND
   (GRAPHNODE (COND
                ((KEYDOWNP 'LSHIFT)
                 (INSPECT GRAPHNODE))
                (T (PROG (COMMAND.MENU COMMAND)
                        (SETQ COMMAND.MENU (MAKE.GRAPH.MIDDLEBUTTONFN.MENU))
                        (SETQ COMMAND (MENU COMMAND.MENU))
                        (SELECTQ COMMAND
                         (NIL NIL)
                         (INSPECT (INSPECT (MAKE.GRAPH.DATUM GRAPHNODE)))
                         (MAKE.SUBGRAPH
                          (MAKE.GRAPH.MAKE.SUBGRAPH GRAPHNODE WINDOW))
                         (ERROR)))))])))]

```

(MAKE.GRAPH.MIDDLEBUTTONFN.MENU

```

[LAMBDA NIL (* DAHJr " 6-MAY-83 18:39")
  (OR MAKE.GRAPH.MIDDLEBUTTONFN.MENU (SETQ MAKE.GRAPH.MIDDLEBUTTONFN.MENU (create MENU
    ITEMS _ ' (INSPECT MAKE.SUBGRAPH
    )
    CENTERFLG _ T
    CHANGEOFFSETFLG _ T))

```

(MAKE.GRAPH.NODE.ALREADY.SEENP

```

[LAMBDA (NODE NODES) (* DAHJr "11-MAR-83 09:34")
  (for ND in NODES thereis (AND (EQ (CAR ND)
    (CAR NODE))
    (EQ (CDR ND)
    (CDR NODE))])

```

(MAKE.GRAPH.NODE.SONS

```

[LAMBDA (DATUM) (* DAHJr " 8-MAR-83 14:29")
  (COND
    [(FMEMB (CAR DATUM) ' (SONS ROOTS))
    (LIST (CONS (CADR DATUM) 'NODE.SPECS)]
    (T (LIST (CONS (CADR DATUM) 'VALUE]))

```

(MAKE.GRAPH.NODE.SPECS.LABEL

```

[LAMBDA (DATUM) (* DAHJr "10-MAR-83 09:55")
  (SELECTQ (CAR DATUM)
    (EVAL 'EVAL)
    (LIST 'LIST)
    (UNION 'UNION)
    (TRACE 'TRACE)
    'SPEC.PAIR])

```

(MAKE.GRAPH.NODE.SPECS.SONS

```

[LAMBDA (DATUM) (* DAHJr "10-MAR-83 09:53")
  (SELECTQ (CAR DATUM)
    (EVAL (LIST (CONS (CADR DATUM) 'VALUE)))
    (LIST (for ELEM in (CDR DATUM) collect (CONS ELEM 'NODE.SPEC)))
    (UNION (for ELEM in (CDR DATUM) collect (CONS ELEM 'NODE.SPECS)))
    (TRACE (LIST (CONS (CADR DATUM) 'NODE.SPECS)))
    (LIST (CONS (CAR DATUM) 'NEW.DATUM.SPEC)
    (CONS (CADR DATUM) 'NEW.STATE.SPEC))

```

(MAKE.GRAPH.PROP.PAIRS

```

[LAMBDA (PLIST)
  (for ELEMENT on PLIST by (CDDR ELEMENT) collect ELEMENT])

```

(MAKE.GRAPH.SHOW.LIST

```

[LAMBDA (OBJECT DEPTH) (* DAHJr " 6-MAY-83 18:20")
  (PROG (ROOTS SPEC.SPEC)
    [SETQ ROOTS (LIST (CONS OBJECT 'OBJECT)
    (RETURN (MAKE.GRAPH NIL "A list" MAKE.GRAPH.LIST.SPEC ROOTS NIL NIL NIL T DEPTH))

```

(MAKE.GRAPH.SHOW.SPEC

```

[LAMBDA (SPEC) (* DAHJr " 6-MAY-83 18:50")
  (PROG (ROOTS SPEC.SPEC)
    [SETQ ROOTS (LIST (CONS SPEC 'GRAPH.SPEC)
    (RETURN (MAKE.GRAPH NIL "A graph specification" MAKE.GRAPH.SPEC.SPEC ROOTS NIL NIL NIL T))

```

(MAKE.GRAPH.NODE.TYPE

```

[LAMBDA (GRAPHNODE) (* DAHJr " 8-MAR-83 18:43")
  (CDR (fetch (GRAPHNODE NODEID) of GRAPHNODE])

```

(MAKE.GRAPH.STATE

```

[LAMBDA (GRAPHNODE) (* rdh%: "10-Jul-85 17:14")
  (MAKE.GRAPH.NODE.TYPE GRAPHNODE])

```

(MAKE.GRAPH.UPDATE.WINDOW

```

[LAMBDA (WINDOW) (* DAHJr " 6-MAY-83 18:44")
  (MAKE.GRAPH WINDOW (WINDOWPROP WINDOW 'TITLE))

```

```

(WINDOWPROP WINDOW 'GRAPH.SPECIFICATION)
(WINDOWPROP WINDOW 'ROOTS)
(WINDOWPROP WINDOW 'CONTEXT)
(WINDOWPROP WINDOW 'LEFTBUTTONFN)
(WINDOWPROP WINDOW 'MIDDLEBUTTONFN)
(WINDOWPROP WINDOW 'TOPJUSTIFYFLG)
(WINDOWPROP WINDOW 'DEPTH)

```

)

```

(FILESLoad (FROM VALUEOF LISPUSERSDIRECTORIES)
  GRAPHER)

```

```

(RPAQQ MAKE.GRAPH.INTERNAL.TITLE.FN.MENU NIL)

```

```

(RPAQQ MAKE.GRAPH.LIST.SPEC
  [OBJECT (DOC (ANY LISP OBJECT)
    LABEL
    (COND ((LISTP DATUM)
      " ( )")
      (T DATUM))
    SONS
    ((COND ((LISTP DATUM)
      DATUM)
      (T NIL))
      'OBJECT])

```

```

(RPAQQ MAKE.GRAPH.MIDDLEBUTTONFN.MENU NIL)

```

```

(RPAQQ MAKE.GRAPH.SPEC.SPEC
  (GRAPH.SPEC (DOC (A PLIST OF STATE.SPECS)
    LABEL
    'GRAPH.SPEC SONS ((MAKE.GRAPH.PROP.PAIRS DATUM)
      'STATE.SPEC))
    STATE.SPEC
    (DOC (A PLIST OF PROPERTIES)
      LABEL
      (CAR DATUM)
      SONS
      ((MAKE.GRAPH.PROP.PAIRS (CADR DATUM))
        'PROPERTY))
    PROPERTY
    (DOC (A PROPERTY, EG. DOC, LABEL, FONT, SONS, ROOTS)
      LABEL
      (CAR DATUM)
      SONS
      (EVAL (MAKE.GRAPH.NODE.SONS DATUM)))
    NODE.SPECS
    (DOC (A SPEC OF DATUM/STATE PAIRS)
      LABEL
      (MAKE.GRAPH.NODE.SPECS.LABEL DATUM)
      SONS
      (EVAL (MAKE.GRAPH.NODE.SPECS.SONS DATUM)))
    NODE.SPEC
    [DOC (A SPEC OF A SINGLE DATUM/STATE PAIR)
      LABEL
      'NODE.SPEC SONS (LIST ((CAR DATUM)
        'NEW.DATA.SPEC)
        ((CADR DATUM)
        'NEW.STATE.SPEC]
    NEW.DATA.SPEC
    (DOC (THE NEW.DATUM.SPEC)
      LABEL
      'DATA SONS ((LIST DATUM)
        'VALUE))
    NEW.DATUM.SPEC
    (DOC (THE NEW.DATUM.SPEC)
      LABEL
      'DATUM SONS ((LIST DATUM)
        'VALUE))
    NEW.STATE.SPEC
    (DOC (THE NEW.STATE.SPEC)
      LABEL
      'STATE SONS ((LIST DATUM)
        'VALUE))
    VALUE
    (DOC (A VALUE)
      LABEL DATUM))

```

```

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```

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