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(*****Modules: ouverture des modules nécessaire*****)
#open "graphics";;
#open "sys";;
#open "random";;
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(*****Variables: déclaration des constantes*****)
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```
let gris= rgb 192 192 192;;
let grisfonce= rgb 128 128 128;;
let grisclaire=rgb 225 225 225;;
let coul= function
  |1->rgb 0 0 255
  |2->rgb 0 128 0
  |3->rgb 255 0 0
  |4->rgb 0 0 128
  |5->rgb 128 0 0
  |6->rgb 255 255 0
  |7->rgb 255 0 255
  |8->rgb 0 0 0
  |_->white;;
```

```
type sondage = Explosion | Bord | Voisin of int;;
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```
(* 9: champ libre caché
  10: champ miné caché
  11: champ miné dévoilé
  13: bord
  14: mine activé
  15: victoire
  16: drapeau vrai
  17: drapeau faux
  0: champ sans mine voisine dévoilé
  n: champ à n mines voisines dévoilé *)
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```
let creer_champ n p nb=
let champ=make_matrix (n+2) (p+2) 9 in
for k=0 to n+1 do champ.(k).(0)<-13;champ.(k).(p+1)<-13 done;
for k=0 to p+1 do champ.(0).(k)<-13;champ.(n+1).(k)<-13 done;
let k=ref 0 in
while !k<>nb do
  let i,j=((random__int n)+1),((random__int p)+1) in
  if not champ.(i).(j)=10 then begin
    champ.(i).(j)<-10;
    incr k;
  end;
done;
champ;;
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```
let sonde champ i j =
  if champ.(i).(j)=10 then Explosion
  else if champ.(i).(j)=13 then Bord
  else begin
    let v=ref 0 in
    for k=(-1) to 1 do
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for l=(-1) to 1 do
  if champ.(i+k).(j+l)=10 || champ.(i+k).(j+l)=11 || champ.(i+k).(j+l)=16 then incr v;
done; done;Voisin(!v);
end;;

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let fait_carre x y col0 col1 col2 col3=
set_color col0;
moveto x y;
lineto (x+25) y;
lineto (x+25) (y-25);
lineto x (y-25);
lineto x y;
set_color col2;
fill_rect (x+1) (y-24) 24 24;
set_color col1;
fill_rect (x+1) (y-24) 3 24;
fill_rect (x+1) (y-3) 24 3;
set_color col3;
fill_rect (x+4) (y-24) 21 3;
fill_rect (x+22) (y-24) 3 21;;

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let fait_bombe x y col0 col1 col2 col3=
set_color col0;
moveto x y;
lineto (x+25) y;
lineto (x+25) (y-25);
lineto x (y-25);
lineto x y;
set_color col1;
fill_rect (x+1) (y-24) 24 24;
set_color col2;
fill_circle (x+13) (y-13) 8;
fill_rect (x+2) (y-13) 22 3;
fill_rect (x+12) (y-23) 3 22;
set_color col3;
fill_circle (x+11) (y-11) 2;;

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let fait_drapeau x y col0 col1 col2 col3 col4 col5=
fait_carre x y col0 col1 col2 col3;
set_color col5;
fill_rect (x+5) (y-20) 17 3;
fill_rect (x+16)(y-20) 3 15;
set_color col4;
fill_poly [|((x+5),(y-11));((x+16),(y-7));((x+16),(y-15))|];;

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```

let cliquer champ nb_mines=
let carre=ref (0,0) in
let mauvais_clique=ref true in
while !mauvais_clique do
let attend=ref (wait_next_event[Button_down;Mouse_motion;Key_pressed]) in
let x,y=(!attend.mouse_x -50),(!attend.mouse_y +25) in

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if x<25*(vect_length champ-1) && y>(size_y()-25*(vect_length champ.(0)-1)) && x>=0 &&
y<=size_y() then
  begin
    if (champ.(fst !carre).(snd !carre)=10 || champ.(fst !carre).(snd !carre)=9) then
      fait_carre ((fst !carre)*25+50) (size_y() -(snd !carre)*25-25) black white gris grisforce;
      carre:=((x quo 25), ((size_y()-y) quo 25));
      if (champ.(fst !carre).(snd !carre)=10 || champ.(fst !carre).(snd !carre)=9) ||
        (champ.(fst !carre).(snd !carre)=16 || champ.(fst !carre).(snd !carre)=17) then
        begin
          if !attend.keypressed then
            begin
              if champ.(fst !carre).(snd !carre)=9 then champ.(fst !carre).(snd !carre)<-17
            else if champ.(fst !carre).(snd !carre)=10 then champ.(fst !carre).(snd !carre)<-16
            else if champ.(fst !carre).(snd !carre)=16 then champ.(fst !carre).(snd !carre)<-10
            else if champ.(fst !carre).(snd !carre)=17 then champ.(fst !carre).(snd !carre)<-9;
              affiche_case champ (fst !carre) (snd !carre);
              affiche_score champ nb_mines;
            end
          else if !attend.button && (champ.(fst !carre).(snd !carre)=9 || champ.(fst !carre).(snd !carre)=10)
          then
            begin
              fait_carre ((fst !carre)*25+50) (size_y() -(snd !carre)*25-25) black grisforce grisforce grisforce;
              let attend2=ref (wait_next_event[Button_up;]) in
              let x2,y2=(!attend2.mouse_x -50),(!attend2.mouse_y +25) in
              let carre2=((x2 quo 25), ((size_y()-y2) quo 25)) in
              if carre2 = !carre then
                begin
                  sound 1000 10;
                  mauvais_clique:=false;
                  fait_carre ((fst !carre)*25+50) (size_y() -(snd !carre)*25-25) grisforce gris gris gris;
                end;
              end
            else if (champ.(fst !carre).(snd !carre)=10 || champ.(fst !carre).(snd !carre)=9) then
              fait_carre ((fst !carre)*25+50) (size_y() -(snd !carre)*25-25) black white grisclair grisforce;
            end;
          end
        else if (champ.(fst !carre).(snd !carre)=10 || champ.(fst !carre).(snd !carre)=9) then
          fait_carre ((fst !carre)*25+50) (size_y() -(snd !carre)*25-25) black white gris grisforce
        done;(fst !carre,snd !carre);

let affiche_case champ i j=
if champ.(i).(j)=10 || champ.(i).(j)=9 then
  fait_carre (i*25+50) (size_y() -j*25-25) black white gris grisforce
else if champ.(i).(j)=11 then fait_bombe (i*25+50) (size_y() -j*25-25) black gris black white
else if champ.(i).(j)=14 then fait_bombe (i*25+50) (size_y() -j*25-25) black red black white
else if champ.(i).(j)=16 then fait_drapeau (i*25+50) (size_y() -j*25-25) black white gris grisforce red
black
else if champ.(i).(j)=17 then fait_drapeau (i*25+50) (size_y() -j*25-25) black white gris grisforce red
black
else if champ.(i).(j)=160 then fait_bombe (i*25+50) (size_y() -j*25-25) black green black white
else if champ.(i).(j)=170 then fait_carre (i*25+50) (size_y() -j*25-25) black red red red
else

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begin
fait_carre (i*25+50) (size_y() -j*25-25) grisfonce white white white;
set_color (coul (champ.(i).(j)));
moveto (i*25+58) (size_y() -j*25-48);
draw_string (string_of_int champ.(i).(j))
end;;

let affiche_champ champ=
for i=1 to (vect_length champ-2) do
  for j=1 to (vect_length champ.(0)-2) do
    affiche_case champ i j;
  done;
done;;

let rec actualise champ i j= function
|Explosion->champ.(0).(0)<-14;
  champ.(i).(j)<-14;
|Bord->();
|Voisin(0)->champ.(i).(j)<-0;
  if champ.(i+1).(j-1)=10 || champ.(i+1).(j-1)=9
  then actualise champ (i+1) (j-1) (sonde champ (i+1) (j-1));
  if champ.(i+1).(j+0)=10 || champ.(i+1).(j+0)=9
  then actualise champ (i+1) (j+0) (sonde champ (i+1) (j+0));
  if champ.(i+1).(j+1)=10 || champ.(i+1).(j+1)=9
  then actualise champ (i+1) (j+1) (sonde champ (i+1) (j+1));
  if champ.(i+0).(j-1)=10 || champ.(i+0).(j-1)=9
  then actualise champ (i+0) (j-1) (sonde champ (i+0) (j-1));
  if champ.(i+0).(j+1)=10 || champ.(i+0).(j+1)=9
  then actualise champ (i+0) (j+1) (sonde champ (i+0) (j+1));
  if champ.(i-1).(j-1)=10 || champ.(i-1).(j-1)=9
  then actualise champ (i-1) (j-1) (sonde champ (i-1) (j-1));
  if champ.(i-1).(j+0)=10 || champ.(i-1).(j+0)=9
  then actualise champ (i-1) (j+0) (sonde champ (i-1) (j+0));
  if champ.(i-1).(j+1)=10 || champ.(i-1).(j+1)=9
  then actualise champ (i-1) (j+1) (sonde champ (i-1) (j+1));
|Voisin(n)->champ.(i).(j)<-n;;

let affiche_score champ nb_mines=
let nb_drapeau=ref 0 in
let nb_case=ref 0 in
for i=1 to (vect_length champ-2) do
  for j=1 to (vect_length champ.(0)-2) do
    if champ.(i).(j)=16 || champ.(i).(j)=17 then incr nb_drapeau;
    if champ.(i).(j)=9 || champ.(i).(j)=10 then incr nb_case;
  done;
done;
set_color red;
moveto 100 (size_y()-50);
draw_string "Mine(s) restante(s): ";
moveto 270 (size_y()-50);
draw_string (string_of_int (nb_mines - !nb_drapeau));
if !nb_drapeau + !nb_case = nb_mines then champ.(0).(0)<-15;;

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let deminer n p nb_mines=
let champ=creer_champ n p nb_mines in
open_graph "800x600+200+100";
affiche_champ champ;
affiche_score champ nb_mines;
while champ.(0).(0)=13 do
  let (i,j)=cliquer champ nb_mines in actualise champ i j (sonde champ i j);
  affiche_champ champ;
  affiche_score champ nb_mines;
done;
for k=1 to (vect_length champ-2) do
for l=1 to (vect_length champ.(0)-2) do
  if champ.(k).(l)=10 then champ.(k).(l)<-11;
  if champ.(k).(l)=16 then champ.(k).(l)<-160;
  if champ.(k).(l)=17 then champ.(k).(l)<-170;
done;
done;
affiche_champ champ;
if champ.(0).(0)=14 then
begin
  moveto 80 (size_y()-20);
  set_color red;
  draw_string "Vous avez perdu !! (cliquez pour quitter)";
  sound 80 100;
  sound 70 100;
  sound 60 100;
  sound 40 300;
end;
if champ.(0).(0)=15 then
begin
  moveto 80 (size_y()-20);
  set_color green;
  draw_string "Vous avez gagné !! (cliquez pour quitter)";
  sound 60 100;
  sound 70 100;
  sound 80 100;
  sound 100 300;
end;
let a=wait_next_event[Button_down] in ();
close_graph();;

deminer 15 15 20;;

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