**Programmation du Démineur**

1. Ecrire le programme qui permet de remplir de 0 un tableau ***grille*** de 10x10 entiers.
2. Mettre le programme de la question 1) dans une procédure **Initialiser\_grille()**
3. Ecrire la procédure **Afficher\_grille()** qui permet d’afficher le contenu du tableau ***grille*** à l’écran.

*Résultat :*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. En utilisant les codes des caractères ASCII, écrire la procédure **Initialiser\_grille\_joueur ()** qui permet de remplir un tableau **grille\_joueur** de 10x10 caractères par des un carré noir. Pour afficher ou saisir un caractère ASCII il suffit de maintenir la touche Alt et de taper le code décimal DEC correspondant puis de relâcher la touche Alt

Su

End Sub



Alt(218)=┌ Alt(191)=┐ Alt(195)=├ Alt(193)=┴ Alt(219)=█

Alt(196)=─ Alt(179)=│ Alt(197=┼ Alt(180)=┤

Alt(194)=┬ Alt(180)=┤ Alt(192)=└ Alt(217)=┘

1. En utilisant les codes des caractères ASCII, écrire la procédure **Afficher\_grille\_joueur()** qui permet d’afficher la **grille\_joueur** à l’écran.

*Résultat :*

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End If

Next

End Sub

1. Ecrire la procédure **poser\_une\_mine()** qui permet de placer une mine aléatoirement dans le tableau ***grille***. La pose d’une mine sera représentée par l’écriture d’un 9 dans le tableau ***grille***.

*Résultat :*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. Réaliser la procédure **poser\_dix\_mines()** afin de placer aléatoirement 10 mines dans le tableau ***grille***. La pose d’une mine sera représentée par l’écriture d’un 9 dans le tableau ***grille***. Il faut obligatoirement 10 mines par une de plus pas une de moins.

*Résultat :*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 |
| 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 |
| 0 | 0 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 9 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 |
| 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |

Appel de la procédure

1. Ecrire la procédure **coordonnées\_mines()** qui parcourt le tableau ***grille***, qui détecte une mine et qui permet d’afficher les coordonnées de chacune des mines.

*Résultat :*

Mine1 : 1 ;8 Mine2 : 2 ;2 Mine3 : 3 ;9 Mine4 : 4 ;3 Mine5 : 4 ;4

Mine6 : 6 ;8 Mine7 : 7 ;2 Mine8 : 7 ;6 Mine9 : 8 ;3 Mine10 : 10 ;10

Appel de la

1. Pour la Mine 1, donnez les coordonnées des cases entourant cette mine. Idem pour la Mine 2, la Mine 5 et la Mine 10.
2. Soit ***ligne\_mine*** et ***colonne\_mine*** les cordonnées de la Mine1 exprimez les coordonnées des cases entourant cette mine en fonction de ***ligne\_mine*** et ***colonne\_mine***.
3. Que se passe-t-il pour les coordonnées des cases entourant la Mine 1 et la Mine 10 ?

Certaines des coordonnées des cases sont en dehors de l’index

1. Que faut-il faire pour résoudre le problème des coordonnées en dehors du tableau ***grille*** ?

Pour résoudre le problème il faut ignorer l’erreur pour la suite s’exécute sans prendre en compte les erreurs

1. Ecrire la procédure **Contour-mine()** qui permet de parcourir toutes les cases entourant une mine et d’incrémenter de 1 chacune de ces cases. Attention il ne faut pas incrémenter les cases contenant les mines. Vous passerez Lig\_mine et col\_mine comme paramètres en plus de grille.

*Résultat :*

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 9 | 1 | 0 |
| 1 | 9 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 1 |
| 1 | 2 | 3 | 2 | 1 | 0 | 0 | 1 | 9 | 1 |
| 0 | 1 | 9 | 9 | 1 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 |
| 1 | 9 | 2 | 1 | 1 | 9 | 1 | 0 | 0 | 0 |
| 1 | 2 | 9 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 9 |

1. Ecrire dans le programme principal un programme qui demande à l’utilisateur de saisir les coordonnées (**pos\_ligne** et **pos\_col**) d’une case du tableau ***grille*** et qui:

Affiche « Perdu vous êtes tombé sur une mine » si c’est un 9

Sinon

de tester si la case de **grille-joueur** est dévoilée ou non ( « █ » ou «  » )

si la case est non dévoilée case **grille\_joueur** = « █ » alors de copier la valeur de la case grille dans la case **grille\_joueur** et d’afficher la grille\_joueur

exemple de contenu de la grille

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 9 | 1 | 0 |
| 1 | 9 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 1 |
| 1 | 2 | 3 | 2 | 1 | 0 | 0 | 1 | 9 | 1 |
| 0 | 1 | 9 | 9 | 1 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 |
| 1 | 9 | 2 | 1 | 1 | 9 | 1 | 0 | 0 | 0 |
| 1 | 2 | 9 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 9 |

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| Coordonnées saisies  N° de la ligne : 2  N° de la colonne : 2   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 9 | 1 | 0 | | 1 | 9 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 1 | | 1 | 2 | 3 | 2 | 1 | 0 | 0 | 1 | 9 | 1 | | 0 | 1 | 9 | 9 | 1 | 0 | 0 | 1 | 1 | 1 | | 0 | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 1 | 0 | | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | | 1 | 9 | 2 | 1 | 1 | 9 | 1 | 0 | 0 | 0 | | 1 | 2 | 9 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 9 |   Affichage  Perdu vous êtes tombé sur une mine | Coordonnées saisies  N° de la ligne : 3  N° de la colonne : 3   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 9 | 1 | 0 | | 1 | 9 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 1 | | 1 | 2 | 3 | 2 | 1 | 0 | 0 | 1 | 9 | 1 | | 0 | 1 | 9 | 9 | 1 | 0 | 0 | 1 | 1 | 1 | | 0 | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 1 | 0 | | 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 | | 1 | 9 | 2 | 1 | 1 | 9 | 1 | 0 | 0 | 0 | | 1 | 2 | 9 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 9 |   Affichage   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | 3 | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | | █ | █ | █ | █ | █ | █ | █ | █ | █ | █ | |

1. Modifier le programme principal afin de demander à l’utilisateur de saisir les coordonnées d’une case du tableau ***grille*** tant qu’il ne tombe pas sur une mine
2. Ecrire une procédure **dévoile\_case()** qui permet de dévoiler les cases autour de la case saisie. Vous passerez comme paramètre le tableau **grille** contenant les valeurs des cases, le tableau **grille\_joueur** qui contient les cases dévoilées, **pos\_lig** et **pos\_col** qui seront les coordonnées de la case saisie.

Coordonnées saisies

N° de la ligne : 3

N° de la colonne : 3

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 1 | 0 | 0 | 0 | 1 | 9 | 1 | 0 |
| 1 | 9 | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 1 |
| 1 | 2 | 3 | 2 | 1 | 0 | 0 | 1 | 9 | 1 |
| 0 | 1 | 9 | 9 | 1 | 0 | 0 | 1 | 1 | 1 |
| 0 | 1 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | 1 | 0 |
| 1 | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 0 |
| 1 | 9 | 2 | 1 | 1 | 9 | 1 | 0 | 0 | 0 |
| 1 | 2 | 9 | 1 | 1 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 9 |

Affichage

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1. Modifier la procédure **dévoile\_case()** afin de ne pas afficher les cases contenant une mine et d’afficher un «  » lorsque que c’est un 0

Affichage

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1. Dans le jeu du démineur la découverte des cases se fait jusqu’aux limites des valeurs d’un nombre de mines adjacentes.

Dans notre exemple pour la case 10 ; 5 saisie nous aurions cet affichage

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| █ | █ | █ | 1 | 1 | 1 | 1 |  | 1 | 1 |
| █ | █ | █ | 1 |  |  |  |  | 1 | █ |

Nous allons utiliser cette procédure **dévoile\_case()** en mode récursivité. C’est-à-dire que cette procédure va s’appeler elle-même à chaque fois qu’elle rencontrera une case vide.

Le premier appel de la procédure dévoilera les cases vertes suivantes lors du passage des coordonnées de la case orange (**pos\_lig** et **pos\_col)**

La première case vide (en considérant que l’on parcourt les cases adjacences de haut en bas et de gauche à droite) sera la case bleue.

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Dans cette procédure dès qu’une case sera vide elle s’appellera cette même procédure

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Dans cette procédure dès qu’une case sera vide elle s’appellera cette même procédure

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Dans cette procédure dès qu’une case sera vide elle s’appellera cette même procédure

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Dans cette procédure dès qu’une case sera vide elle s’appellera cette même procédure

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure H en dépilant

Ligne=5 et col=10

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure G en dépilant

Ligne=6 et col=10

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Dans cette procédure dès qu’une case sera vide elle s’appellera cette même procédure

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure G en dépilant

Ligne=8 et col=10

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure F en dépilant

Ligne=7 et col=10

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure E en dépilant

Ligne=8 et col=9

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure D en dépilant

Ligne=8 et col=8

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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Dans cette procédure dès qu’une case sera vide elle s’appellera cette même procédure

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure D en dépilant

Ligne=10 et col=8

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure C en dépilant

Ligne=9 et col=8

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure B en dépilant

Ligne=10 et col=7

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La dernière procédure a terminé tout son code donc on revient à l’appel de la procédure A en dépilant

Ligne=10 et col=6

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