INF3500 – Automne 2024

Exercices #0 – revue – analyse et synthèse de fonctions combinatoires

### Donnez la table de vérité des portes logiques suivantes.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| F3  F2  F1  F0 | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *x* | *y* | *F*o | *F*1 | *F*2 | *F*3 | | 0 | 0 | 1 | 1 | 1 | 0 | | 0 | 1 | 1 | 0 | 1 | 1 | | 1 | 0 | 0 | 1 | 1 | 1 | | 1 | 1 | 1 | 1 | 0 | 1 | |

### Donnez la table de vérité des portes logiques suivantes.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| F2  F1  F0 | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *A* | *B* | *C* | *F*o | *F*1 | *F*2 | | 0 | 0 | 0 | 0 | 1 | 1 | | 0 | 0 | 1 | 1 | 1 | 0 | | 0 | 1 | 0 | 1 | 1 | 0 | | 0 | 1 | 1 | 1 | 1 | 0 | | 1 | 0 | 0 | 1 | 1 | 0 | | 1 | 0 | 1 | 1 | 1 | 0 | | 1 | 1 | 0 | 1 | 1 | 0 | | 1 | 1 | 1 | 1 | 0 | 0 | |

### Donnez la table de vérité correspondant aux équations booléennes suivantes.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| F = ABCD’ + AB’C’D’ + A’BCD  G = A + B + D’  H = (A + BC)(A’ + C’D’)  I = AB’ + (BC + D’)(A’ + D’) | |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | | *A* | *B* | *C* | *D* | *F* | *G* | *H* | *I* | | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | |

### Donnez la table de vérité et une équation booléenne correspondant au circuit suivant.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  |  |  |  | | --- | --- | --- | --- | | *A* | *B* | *C* | *F*1 | | 0 | 0 | 0 | 0 | | 0 | 0 | 1 | 0 | | 0 | 1 | 0 | 0 | | 0 | 1 | 1 | 1 | | 1 | 0 | 0 | 0 | | 1 | 0 | 1 | 0 | | 1 | 1 | 0 | 0 | | 1 | 1 | 1 | 0 | |

Réponse : F1 = A’BC

### Donnez la table de vérité et une équation booléenne correspondant aux circuits suivants.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *A* | *B* | *C* | *D* | *F3* | *F5* | | 0 | 0 | 0 | 0 | 0 | 1 | | 0 | 0 | 0 | 1 | 0 | 1 | | 0 | 0 | 1 | 0 | 0 | 1 | | 0 | 0 | 1 | 1 | 0 | 0 | | 0 | 1 | 0 | 0 | 0 | 1 | | 0 | 1 | 0 | 1 | 0 | 1 | | 0 | 1 | 1 | 0 | 0 | 1 | | 0 | 1 | 1 | 1 | 0 | 1 | | 1 | 0 | 0 | 0 | 1 | 1 | | 1 | 0 | 0 | 1 | 0 | 1 | | 1 | 0 | 1 | 0 | 0 | 1 | | 1 | 0 | 1 | 1 | 0 | 0 | | 1 | 1 | 0 | 0 | 0 | 1 | | 1 | 1 | 0 | 1 | 0 | 0 | | 1 | 1 | 1 | 0 | 0 | 1 | | 1 | 1 | 1 | 1 | 0 | 0 | |

Réponses :

F3 = AB’C’D’

F5 = (A + B + C’ +D’)(A’ + B + C’ + D’)(A’ + B’ + C + D’)(A’ + B’ + C’ + D’)

### Donnez la table de vérité et une équation booléenne correspondant aux circuits suivants.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | *A* | *B* | *C* | *D* | *E* | *F9* | | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | 0 | 0 | 1 | 0 | | 0 | 0 | 0 | 1 | 0 | 0 | | 0 | 0 | 0 | 1 | 1 | 0 | | 0 | 0 | 1 | 0 | 0 | 0 | | 0 | 0 | 1 | 0 | 1 | 0 | | 0 | 0 | 1 | 1 | 0 | 0 | | 0 | 0 | 1 | 1 | 1 | 0 | | 0 | 1 | 0 | 0 | 0 | 1 | | 0 | 1 | 0 | 0 | 1 | 0 | | 0 | 1 | 0 | 1 | 0 | 0 | | 0 | 1 | 0 | 1 | 1 | 0 | | 0 | 1 | 1 | 0 | 0 | 0 | | 0 | 1 | 1 | 0 | 1 | 0 | | 0 | 1 | 1 | 1 | 0 | 0 | | 0 | 1 | 1 | 1 | 1 | 0 | | 1 | 0 | 0 | 0 | 0 |  | | 1 | 0 | 0 | 0 | 1 |  | | 1 | 0 | 0 | 1 | 0 |  | | 1 | 0 | 0 | 1 | 1 |  | | 1 | 0 | 1 | 0 | 0 |  | | 1 | 0 | 1 | 0 | 1 |  | | 1 | 0 | 1 | 1 | 0 |  | | 1 | 0 | 1 | 1 | 1 |  | | 1 | 1 | 0 | 0 | 0 |  | | 1 | 1 | 0 | 0 | 1 |  | | 1 | 1 | 0 | 1 | 0 |  | | 1 | 1 | 0 | 1 | 1 |  | | 1 | 1 | 1 | 0 | 0 |  | | 1 | 1 | 1 | 0 | 1 |  | | 1 | 1 | 1 | 1 | 0 |  | | 1 | 1 | 1 | 1 | 1 |  | |

### Donnez une équation booléenne et un circuit logique correspondant aux fonctions logiques de la table de vérité suivante.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| *A* | *B* | *C* | *T* | *U* | *V* | *W* | *X* |
| 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 |
| 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 |

Réponses

T = A’B’C’ + A’ BC + AB’C; U = 0; V = 1; W = A’ + B + C; X = A

|  |  |  |  |
| --- | --- | --- | --- |
| |  |  | | --- | --- | |  |  | |  |

### Faites la conception'un circuit numérique qui accepte en entrée un nombre entier positif A exprimé sur 4 bits, et qui indique si le nombre est pair, s’il est divisible par 3, s’il est divisible par 5, et s’il est premier.

#### Identifiez les entrées et les sorties

#### Composez la table de vérité

#### Écrivez les équations booléennes des sorties

#### (Réduisez les équations booléennes)

#### Donnez le circuit correspondant

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *A* | *A3* | *A2* | *A1* | *A0* | *Pair* | *Divpar3* | *Divpar5* | *Premier* |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| 3 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 |
| 4 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 |
| 6 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| 7 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 |
| 8 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 10 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| 11 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 12 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| 13 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 14 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| 15 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |

|  |  |
| --- | --- |
|  |  |
|  |  |

### Faites la conception d'un circuit numérique qui calcule le carré d’un nombre entier positif A exprimé sur 4 bits. La sortie S = A2 doit être un nombre entier positif exprimé sur 8 bits.

#### Identifiez les entrées et les sorties

#### Composez la table de vérité

#### Écrivez les équations booléennes des sorties

#### (Réduisez les équations booléennes)

#### Donnez le circuit correspondant

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *A* | *A3* | *A2* | *A1* | *A0* | *S7* | *S6* | *S5* | *S4* | *S3* | *S2* | *S1* | *S0* |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 3 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 |
| 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 5 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| 6 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 7 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| 8 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 |
| 10 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| 11 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 |
| 12 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 13 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 |
| 14 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| 15 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 |

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