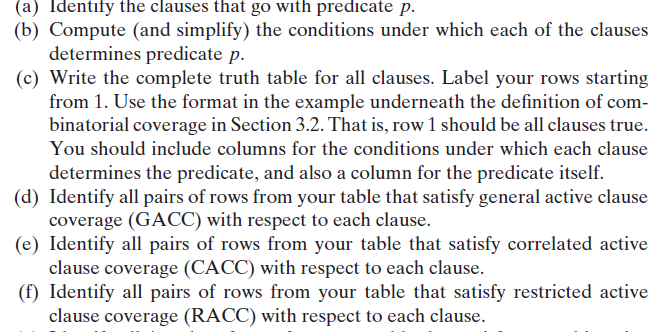
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Exercise Section 3.2. Problems 7 and 9, including (a) to (f).



7. *p* = (*a* ∨ *b*) ∧ (*c* ∨ *d*)

a) The clauses the go with predicate P are a, b, c, d

b) Pa = Pa = true ⊕pa=false

Pa = true = (T ∨ *b*) ∧ (*c* ∨ *d*) Pa = false = (F ∨ *b*) ∧ (*c* ∨ *d*)

Pa = true =T ∧ (*c* ∨ *d*) Pa = false = *b* ∧ (*c* ∨ *d*)

Pa = true = (*c* ∨ *d*)

Pa = (*c* ∨ *d*) ⊕ *b* ∧ (*c* ∨ *d*)

Pa = ((c ∨ *d*) ∧ ¬ ((c ∨ *d*) ∧ b)) ∨ (¬ (c v d) ∧ ((c ∨ *d*) ∧ b))

Pa = ((c ∨ *d*) ∧ ¬ ((c ∨ *d*) ∧ b)

Pa = ((c ∨ *d*) ∧ ¬ ((c ∨ *d*) ∧ b)

**Pa = ¬b ∧ (c∨ d)**

Pb = Pb = true ⊕pb=false

Pb = true = (a ∨ *T*) ∧ (*c* ∨ *d*) Pb = false = (a ∨ *F*) ∧ (*c* ∨ *d*)

Pb = true = a ∧ (*c* ∨ *d*) Pb = false = a ∧ (*c* ∨ *d*)

Pb = a ∧ (*c* ∨ *d*) ⊕ a ∧ (*c* ∨ *d*)

Pb = ((c ∨ *d*) ∧ ¬ ((c ∨ *d*) ∧ a)) ∨ (¬ (c v d) ∧ ((c ∨ *d*) ∧ a))

Pb = ((c ∨ *d*) ∧ ¬ ((c ∨ *d*) ∧ a)

Pb = ((c ∨ *d*) ∧ ¬ (c ∨ *d*) ∧ ¬a

**Pb = ¬a ∧ (c∨ d)**

Pc = Pc = true ⊕pc=false

Pc = true = (a ∨ *b*) ∧ (*T* ∨ *d*) Pc = false = (a ∨ *b*) ∧ (*F* ∨ *d*)

Pc = true = (a ∨ *b*) ∧ T Pc = false = (a ∨ *b*) ∧ d

Pc = true = (a ∨ *b*)

Pc = (a ∨ *b*) ⊕ (a ∨ *b*) ∧ d

Pc = ((a ∨ *b*) ∧ ¬ ((a ∨ *b*) ∧ d)) ∨ (¬ (a v b) ∧ ((a ∨ *b*) ∧ d))

Pc = ((a ∨ *b*) ∧ ¬ ((a ∨ *b*) ∧ d)

Pc = ((a ∨ *b*) ∧ ¬ (a ∨ *b*) ∧ ¬d

**Pc = ¬d ∧ (a ∨ b)**

Pd = Pd = true ⊕pd=false

Pd = true = (a ∨ *b*) ∧ (*c* ∨ *T*) Pd = false = (a ∨ *b*) ∧ (*c* ∨ *F*)

Pd = true = (a ∨ *b*) ∧ T Pd = false = (a ∨ *b*) ∧ c

Pd = true = (a ∨ *b*)

Pd = (a ∨ *b*) ⊕ (a ∨ *b*) ∧ c

Pd = ((a ∨ *b*) ∧ ¬ ((a ∨ *b*) ∧ c)) ∨ (¬ (a v b) ∧ ((a ∨ *b*) ∧ c))

Pd  = ((a ∨ *b*) ∧ ¬ ((a ∨ *b*) ∧ c)

Pd  = ((a ∨ *b*) ∧ ¬ (a ∨ *b*) ∧ ¬c

**Pd = ¬c ∧ (a ∨ b)**

C)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | a | b | c | d | P | Pa | Pb | Pc | Pd |
| 1 | T | T | T | T | T | F | F | F | F |
| 2 | T | T | T | F | T | F | F | T | F |
| 3 | T | T | F | T | T | F | F | F | T |
| 4 | T | T | F | F | F | F | F | T | T |
| 5 | T | F | T | T | T | T | F | F | F |
| 6 | T | F | T | F | T | T | F | T | F |
| 7 | T | F | F | T | T | T | F | F | T |
| 8 | T | F | F | F | F | F | F | T | T |
| 9 | F | T | T | T | T | F | T | F | F |
| 10 | F | T | T | F | T | F | T | T | F |
| 11 | F | T | F | T | T | F | T | F | T |
| 12 | F | T | F | F | F | F | F | T | T |
| 13 | F | F | T | T | F | T | T | F | F |
| 14 | F | F | T | F | F | T | T | F | F |
| 15 | F | F | F | T | F | T | T | F | F |
| 16 | F | F | F | F | F | F | F | F | F |

d) GACC pairs for clause a are {5, 6, 7} x {13, 14, 15}

GACC pairs for clause b are {9, 10, 11} x {13, 14, 15}

GACC pairs for clause c are {2, 6, 10} x {4, 8, 12}

GACC pairs for clause d are: {3, 7, 11} x {4, 8, 12}

e) CACC pairs for all clauses a, b, c, and d are the same as the GACC pairs.

f) RACC pairs for clause a, (5, 13), (6, 14), (7, 15)

RACC pairs for clause b, (9, 13), (10, 14), (11, 15)

RACC pairs for clause c, (2, 4), (6, 8), (10, 12)

RACC pairs for clause d, (3, 4), (7, 8), (11, 12)

9. *p* = *a* ∨ *b* ∨ (*c* ∧ *d*)

a) The clauses the go with predicate P are a, b, c, d

b) Pa = Pa = true ⊕pa=false

Pa = true = T ∨ *b* ∨ (*c* ∧ *d*) Pa = false = F ∨ *b* ∨ (*c* ∧ *d*)

Pa = true = T ∨ (*c* ∨ *d*) Pa = false = *b* ∨ (*c* ∧ *d*)

Pa = true = T

Pa = T ⊕ *b* ∨ (*c* ∧ *d*)

Pa = ¬ (b ∨ (c ∧ d))

**Pa = ¬b ∧ (¬c ∨ ¬d))**

Pb = Pb = true ⊕pb=false

Pb = true = a ∨ *T* ∨ (*c* ∧ *d*) Pb = false = a ∨ *F* ∨ (*c* ∧ *d*)

Pb = true = T ∨ (*c* ∨ *d*) Pb = false = *a* ∨ (*c* ∧ *d*)

Pb = true

Pb = T ⊕ *b* ∨ (*c* ∧ *d*)

Pb = ((*c* ∨ *d*) ∨ (a ∧ (*c* ∨ *d*)) ∧ (¬(*c* ∨ *d*) ∨ ¬ (a ∧ (*c* ∨ *d*))

Pb = ¬ (b ∨ (c ∧d))

**Pb = ¬a ∧ (¬c ∨ ¬d))**

Pc = Pc = true ⊕pc=false

Pc = true = a ∨ *b* ∨ (*T* ∧ *d*) Pc = false = a ∨ *b* ∨ (*F* ∧ *d*)

Pc = true = (a ∨ *b*) ∨ d Pc = false = (a ∨ *b*) ∨ F

Pc = false = (a ∨ *b*)

Pc = (a ∨ *b*) ∨ d ⊕ (a ∨ *b*)

Pc = (((a v b) v d) ∧ (¬ (a v b))) v ((¬ (a v b) v d)) ∧ (a v b))

Pc = ((a v b) v d) ∧ (¬ (a v b))

**Pc = ¬a ∧ ¬b ∧ d**

Pd = Pd = true ⊕pd=false

Pd = true = a ∨ *b* ∨ (*c* ∧ *T*) Pd = false = a ∨ *b* ∨ (*c* ∧ *F*)

Pd = true = (a ∨ *b*) ∨ c Pd = false = (a ∨ *b*) ∨ F

Pd = false = (a ∨ *b*)

Pd = (a ∨ *b*) ∨ c ⊕ (a ∨ *b*)

Pd = (((a v b) v c) ∧ (¬ (a v b))) v ((¬ (a v b) v c)) ∧ (a v b))

Pd = ((a v b) v c) ∧ (¬ (a v b))  **Pd = ¬a ∧ ¬b ∧ c**

c)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | a | b | c | d | P | Pa | Pb | Pc | Pd |
| 1 | T | T | T | T | T | F | F | F | F |
| 2 | T | T | T | F | T | F | F | F | F |
| 3 | T | T | F | T | T | F | F | F | F |
| 4 | T | T | F | F | T | F | F | F | F |
| 5 | T | F | T | T | T | F | F | F | F |
| 6 | T | F | T | F | T | T | F | F | F |
| 7 | T | F | F | T | T | T | F | F | F |
| 8 | T | F | F | F | T | T | F | F | F |
| 9 | F | T | T | T | T | F | F | F | F |
| 10 | F | T | T | F | T | F | T | F | F |
| 11 | F | T | F | T | T | F | T | F | F |
| 12 | F | T | F | F | T | F | T | F | F |
| 13 | F | F | T | T | T | F | F | T | T |
| 14 | F | F | T | F | F | T | T | F | T |
| 15 | F | F | F | T | F | T | T | T | F |
| 16 | F | F | F | F | F | T | T | F | F |

d) GACC pairs for clause a are {6, 7, 8} x {14, 15, 16}

GACC pairs for clause b are {10, 11, 12} x {14, 15, 16}

GACC pairs for clause c are 13 and 15

GACC pairs for clause d are: 13 and 14

e) CACC pairs for all clauses a, b, c, and d are the same as the GACC pairs.

f) RACC pairs for clause a, (8, 16), (6, 14), (7, 15)

RACC pairs for clause b, (12, 16), (10, 14), (11, 15)

RACC pairs for clause c are 13 and 15

RACC pairs for clause d are 13 and 14