ComS 363
Homework 2

Sean Gordon

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1)

(a) A, C, and D should not be used as key, as each has duplicate values in their respective columns.
B should be used as key as it is the only column without duplicate values.

(b) All unique values in C are accompanied by their own corresponding unique values in D, so the dependenct is satisfied.
$[3 \rightarrow 4]$, $[8 \rightarrow 5]$

(c) All unique values in C are **not** accompanied by their own corresponding unique values in B, so the dependenct is **not** satisfied.
$[8 \rightarrow 3]$, $[8 \rightarrow 7]$

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2)

(a) $AG \rightarrow B \Rightarrow BBB \rightarrow BBCD \Rightarrow BBCDD \sim> BDCBD \rightarrow BDCE \rightarrow BDF$

(b) $B^+ = \{B, CD, CE, F\}$

(c) $\mathbf{AG} \rightarrow \mathbf{B} \Rightarrow BB \rightarrow \mathbf{C}B\mathbf{D} \rightarrow C\mathbf{E} \rightarrow \mathbf{F}$
Starting from AG, all of ABCDEFG can be accessed. Thus, AG is a key.

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3)

    (a) $\{A \rightarrow B, A \rightarrow C\}$

    (b) $\{ABCD \rightarrow E, ABCD \rightarrow F\}$

    (c) $\{A \rightarrow B, A \rightarrow C, C \rightarrow D\}$

    (d) $\{A \rightarrow B, A \rightarrow C, A \rightarrow D\}$

    (e) $\{A \rightarrow B, ACD \rightarrow E, EF \rightarrow G, EF \rightarrow H\}$

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4)

(a) Disproof:

X	Y	Z
X1	Y1	Z1
X1	Y2	Z3

(b)
1. $X \rightarrow YZ$ (given)
2. $X \rightarrow Y$ (decomposition) ✓

(c) Disproof:

W	X	Y	Z
W1	X1	Y1	Z1
W1	X2	Y1	Z2

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5)

    (a) Computing attribute closure:

$$A \rightarrow A \qquad B \rightarrow ABCD \qquad C \rightarrow CD \qquad D \rightarrow D$$
$$AB \rightarrow ABCD \qquad AC \rightarrow ACD \qquad AD \rightarrow AD$$
$$BC \rightarrow ABCD \qquad BD \rightarrow ABCD \qquad CD \rightarrow CD$$
$$ABC \rightarrow ABCD \qquad ABD \rightarrow ABCD \qquad ACD \rightarrow ACD \qquad BCD \rightarrow ABCD$$

As all combinations that result in ABCD rely on B, we can conclude that B is the only non-redundant key.

1.   2.   3.   4.   5.   6.   7.