13.17 Show that the statement of conditional independence
P(X, Y | Z) = P(X | Z).P(Y | Z)
is equivalent to each of the statements
P(X | Y, Z) = P(X | Z) and P(B | X, Z) = P(Y | Z)

Comment: the exercise should say P(Y | X, Z) instead of P(B | X, Z)

I) By statement of conditional independence:
$P(X \wedge Y | Z) = P(X | Z) \times P(Y | Z)$

II) Using the conditional probability definition:
$P(X \wedge Y | Z) = P(X \wedge Y \wedge Z) \times P(Z)$

III) Using the conditional probability definition:
$P(Y | Z) = P(Y \wedge Z) / P(Z)$

IV) Replacing (II) and (III) in (I):
$P(X \wedge Y \wedge Z) / P(Z) = P(X | Z) \times P(Y \wedge Z) / P(Z)$
$P(X \wedge Y \wedge Z) = P(X | Z) \times P(Y \wedge Z)$

V) Using product rule:
$P(X \wedge Y \wedge Z) = P(X | Y \wedge Z) \times P(Y \wedge Z)$

VI) Diving (V) by (IV)
$P(X \wedge Y \wedge Z) / P(X \wedge Y \wedge Z) = P(X | Y \wedge Z) \times P(Y \wedge Z) / (P(X | Z) \times P(Y \wedge Z))$
$P(X | Y \wedge Z) / P(X | Z) = 1$
$P(X | Y \wedge Z) = (P(X | Z)$

Then, saying (I) is equivalent to say that P(X | Y, Z) = P(X | Z)
Q.E.D. (Part 1/2)

VII) Using the conditional probability definition:
$P(X| Z) = P(X \wedge Z) / P(Z)$

VIII) Replacing (II) and (III) in (I):
$P(X \wedge Y \wedge Z) / P(Z) = P(Y | Z) \times P(X \wedge Z) / P(Z)$
$P(X \wedge Y \wedge Z) = P(Y | Z) \times P(X \wedge Z)$

IX) Using product rule:
$P(X \wedge Y \wedge Z) = P(Y | X \wedge Z) \times P(X \wedge Z)$

X) Diving (IX) by (VIII):
$P(X \wedge Y \wedge Z) / P(X \wedge Y \wedge Z) = P(Y | X \wedge Z) \times P(X \wedge Z) / (P(Y | Z) \times P(X \wedge Z))$
$P(Y | X \wedge Z) / P(Y | Z) = 1$
$P(Y | X \wedge Z) = (P(Y | Z)$

Then, saying (I) is equivalent to say that P(Y | X, Z) = P(Y | Z)

Q.E.D. (Part 2/2)