



Maths & Logic (360-124)

Do question 1 on this sheet (be sure to put your name on it!), and the rest of the test (on the next page) in the workbook provided.

(Marks)

- (6) 1. Given the following derivations, show that each is correct by filling in correct justifications (names of rules and line numbers, as required).
(Technical point: in this and in question 2, you may assume there are no variables other than those explicitly shown.)

1	$\exists x \exists y (B(x, y) \wedge B(y, x))$
2	$\forall x \forall y (B(x, y) \rightarrow (A(x) \wedge \neg A(y)))$
3	$u \quad \exists y (B(u, y) \wedge B(y, u))$
4	$v \quad B(u, v) \wedge B(v, u)$
5	$B(u, v)$
6	$B(v, u)$
7	$\forall y (B(u, y) \rightarrow A(u) \wedge \neg A(y))$
8	$B(u, v) \rightarrow A(u) \wedge \neg A(v)$
9	$\forall y (B(v, y) \rightarrow A(v) \wedge \neg A(y))$
10	$B(v, u) \rightarrow A(v) \wedge \neg A(u)$
11	$A(u) \wedge \neg A(v)$
12	$A(v) \wedge \neg A(u)$
13	$A(u)$
14	$\neg A(u)$
15	$A(u) \wedge \neg A(u)$
16	$\exists x (A(x) \wedge \neg A(x))$
17	$\exists x (A(x) \wedge \neg A(x))$
18	$\exists x (A(x) \wedge \neg A(x))$

1	$\forall x \forall y (M(x, y) \rightarrow N(x, y))$
2	$\exists y \forall x M(x, y)$
3	$u \quad v \quad \forall x M(x, v)$
4	$M(u, v)$
5	$M(u, v) \rightarrow N(u, v)$
6	$N(u, v)$
7	$\exists y N(u, y)$
8	$\exists y N(u, y)$
9	$\forall x \exists y N(x, y)$

(Please turn the page over for the rest of the test.)

