Additional Diagram Problems

Sentences:
1. $\forall x(T(x) \rightarrow \exists y(M(y) \wedge A(x,y)))$
2. $\exists x(M(x) \wedge \forall y(T(y) \rightarrow A(y,x)))$
3. $\forall x(T(x) \rightarrow \exists y(M(y) \wedge \neg A(x,y)))$
4. $\exists x(T(x) \wedge \forall y(M(y) \rightarrow \neg A(x,y)))$
5. $\forall x(M(x) \rightarrow \exists y(T(y) \wedge A(y,x)))$
6. $\exists x(M(x) \wedge \forall y(T(y) \rightarrow \neg A(y,x)))$
7. $\forall x(M(x) \rightarrow \exists y(T(y) \wedge \neg A(y,x)))$
8. $\exists x(T(x) \wedge \forall y(M(y) \rightarrow A(x,y)))$
9. $\forall x \forall y((T(x) \wedge T(y) \wedge x \neq y) \rightarrow \exists z(M(z) \wedge A(x,z) \wedge A(y,z)))$
10. $\exists x \exists y(M(x) \wedge M(y) \wedge \forall z(T(z) \rightarrow (A(z,x) \vee A(z,y))))$
11. $\forall x \forall y((T(x) \wedge T(y) \wedge x \neq y) \rightarrow \exists z(M(z) \wedge \neg A(x,z) \wedge \neg A(y,z)))$
12. $\exists x \exists y(T(x) \wedge T(y) \wedge \forall z(M(z) \rightarrow (A(x,z) \vee A(y,z))))$
13. $\exists x \exists y(M(x) \wedge M(y) \wedge \forall z(T(z) \rightarrow (\neg A(z,x) \vee \neg A(z,y))))$
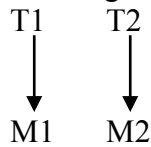14. $\forall x(M(x) \rightarrow \neg \exists y \exists z(T(y) \wedge T(z) \wedge y \neq z \wedge A(y,x) \wedge A(z,x)))$
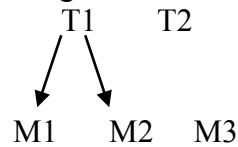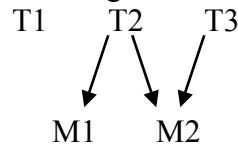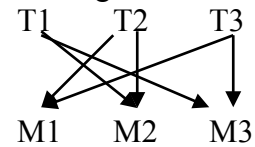
Diagrams:

Diagram 1　Diagram 2　Diagram 3　Diagram 4　Diagram 5　Diagram 6　Diagram 7　Diagram 8
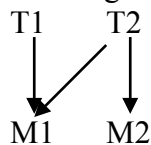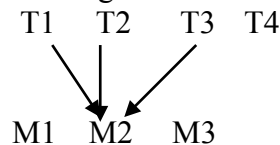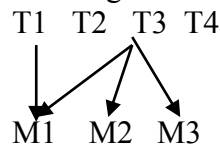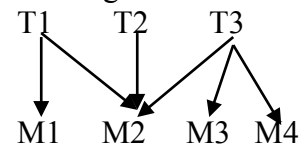
ANSWERS ON NEXT PAGE

Answers:

Sentences:	Answers for	D1	D2	D3	D4	D5	D6	D7	D8
1. ∀x(T(x) → ∃y(M(y) ∧ A(x,y))) - Every teacher attended at least one meeting.		T	F	F	T	T	T	F	T
2. ∃x(M(x) ∧ ∀y(T(y) → A(y,x))) - There is a meeting that every teacher attended.		F	F	F	F	T	T	F	T
3. ∀x(T(x) → ∃y(M(y) ∧ ¬A(x,y))) - For every teacher there is a meeting they did not attend.		T	T	F	T	F	T	F	T
4. ∃x(T(x) ∧ ∀y(M(y) → ¬A(x,y))) - There is a teacher who attended no meetings. (opposite of 1)		F	T	T	F	F	F	T	F
5. ∀x(M(x) → ∃y(T(y) ∧ A(y,x))) - For every meeting there is a teacher attended.		T	F	T	T	T	F	T	T
6. ∃x(M(x) ∧ ∀y(T(y) → ¬A(y,x))) - There is a meeting that no teacher attended. (opposite of 5)		F	T	F	F	F	T	F	F
7. ∀x(M(x) → ∃y(T(y) ∧ ¬A(y,x))) - For every meeting there is a teacher who did not attend. (opposite of 2)		T	T	T	T	F	F	T	F
8. ∃x(T(x) ∧ ∀y(M(y) → A(x,y))) - There is a teacher who attended every meeting. (opposite of 3)		F	F	T	F	T	F	T	F
9. ∀x∀y((T(x) ∧ T(y) ∧ x≠y) → ∃z(M(z) ∧ A(x,z) ∧ A(y,z))) - For every pair of teachers there is a meeting they both attended.		F	F	F	T	T	T	F	T
10. ∃x∃y(M(x) ∧ M(y) ∧ ∀z(T(z) → (A(x,z) ∨ A(z,y)))) - There is a pair of meetings such that every teacher went to one or the other.		T	F	F	T	T	T	F	T
11. ∀x∀y((T(x) ∧ T(y) ∧ x≠y) → ∃z(M(z) ∧ ¬A(x,z) ∧ ¬A(y,z))) - For every pair of teachers there is a meeting that neither attended.		F	T	F	F	F	T	F	F
12. ∃x∃y(T(x) ∧ T(y) ∧ ∀z(M(z) → (A(x,z) ∨ A(y,z)))) - There is a pair of teachers such that for every meeting either the first teacher attended or the second teacher attended.		T	F	T	T	T	F	T	T
13. ∃x∃y(M(x) ∧ M(y) ∧ ∀z(T(z) → (¬A(z,x) ∨ ¬A(z,y)))) - There is a pair of meetings such that every teacher either did not attend the first meeting or did not attend the second meeting.		T	T	F	F	F	T	F	T
14. ∀x(M(x) → ¬∃y∃z(T(y) ∧ T(z) ∧ y≠z ∧ A(y,x) ∧ A(z,x))) - No meeting had two different teachers attending.		T	T	F	F	F	F	F	F