National Institute of Technology Calicut
Department of Computer Science and Engineering
Seventh Semester B. Tech.(CSE)
CS4052D Logic for Computer Science
Assignment 2 B

Submission deadline (on or before):

- 16.11.2020, 11:50 PM

Standard of Conduct

- Violation of academic integrity will be severely penalized. Each student is expected to adhere to high standards of ethical conduct, especially those related to cheating and plagiarism. Any submitted work MUST BE an individual effort. Any academic dishonesty will result in zero marks in the corresponding exam or evaluation and will be reported to the department council for record keeping and for permission to assign F grade in the course. The department policy on academic integrity can be found at: http://cse.nitc.ac.in/sites/default/files/Academic-Integrity_new.pdf.

General Instructions

- Combine all the .v files into one zipped file and upload on the eduserver.
- There shall be bonus marks for good quality proofs.
- You may consult the course notes, slides, recordings and internet for definitions etc. You MUST NOT obtain solutions from the internet.
- You MUST NOT discuss among yourselves. Though, you may discuss with me by mail or by phone – my number is 9962326989.

EXERCISE

(Each Sequent carries 1 Mark)

Write Coq scripts to prove each of the following FOL sequents:

1. $(\forall x)(p(x) \rightarrow q(x)), (\exists x)p(x) \vdash (\exists x)q(x)$
2. $(\forall x)(q(x) \rightarrow r(x)), (\exists x)(p(x) \wedge q(x)) \vdash (\exists x)(p(x) \wedge r(x))$
3. $(\exists x)p(x), (\forall x)(\forall y)(p(x) \rightarrow q(y)) \vdash (\forall y)q(y)$
4. $(\exists x)(\exists y)(H(x,y) \vee H(y,x)), \neg(\exists x)H(x,x) \vdash (\exists x)(\exists y)\neg(x = y)$
5. $(\forall x)(P(x) \leftrightarrow x = b) \vdash P(b) \wedge (\forall x)(\forall y)(P(x) \wedge P(y) \leftrightarrow x = y)$
6. $(\forall y)Q(b,y), (\forall x)(\forall y)(Q(x,y) \rightarrow Q(S(x),S(y))) \vdash (\exists z)(Q(b,z) \wedge Q(z,S(b)))$
7. $(\forall x)(\forall y)(\forall z)(S(x,y) \wedge S(y,z) \rightarrow S(x,z)), (\forall x)\neg S(x,x) \vdash (\forall x)(\forall y)(S(x,y) \rightarrow \neg S(y,x))$
8. $(\forall x)(P(x) \vee Q(x)), (\exists x)\neg Q(x), (\forall x)(R(x) \rightarrow \neg P(x)) \vdash (\exists x)\neg R(x)$
9. $(\forall x)(P(x) \rightarrow (Q(x) \vee R(x))), \neg(\exists x)(P(x) \wedge R(x)) \vdash (\forall x)(P(x) \rightarrow Q(x))$
10. $(\exists x)(\exists y)(S(x,y) \vee S(y,x)) \vdash (\exists x)(\exists y)S(x,y)$
11. $(\exists x)(P(x) \wedge Q(x)), (\forall y)(P(x) \rightarrow R(x)) \vdash (\exists x)(R(x) \wedge Q(x))$
12. $(\forall x)(p(x) \rightarrow q(x)) \vdash (\forall x)\neg q(x) \rightarrow (\forall x)\neg p(x)$
13. $(\forall x)(p(x) \rightarrow \neg q(x)) \vdash \neg(\exists x)(p(x) \wedge q(x))$
14. $(\forall x)(p(x) \vee S) \dashv\vdash (\forall x)p(x) \vee S$
15. $(\exists x)(p(x) \wedge S) \dashv\vdash (\exists x)p(x) \wedge S$