# Ad程序 COMP4161 T3/2022 Ad程序 Topio in Staver Shift 輔导

### signment 1

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eptember 2022 and is due on Tuesday 27th September files, PDF (.pdf) files, and Isabelle theory (.thy) files. NOT mean you can work in groups. Each submission plagiarism policy: https://student.unsw.edu.au/plagiarism

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## Assignment Project Exam Help

## Types (15 marks). (a) Provide the most general type for the term $\lambda x$ y z. z x (a y y). Show a type derivation

tree to justify your answer.

Each node of the the should conspond to be application of a single typing rule, indicating which typing rule is used at each step.

Under which contexts is the term type correct? (10 marks)

(b) Find a term that the story of the story

 $('a \Rightarrow 'a \Rightarrow 'b \Rightarrow 'c) \Rightarrow 'a \Rightarrow 'b \Rightarrow 'c)$ 

(You don't need to provide a type derivation, just the term).

(5 marks)

#### 2 $\lambda$ -Calculus (23 marks)

Recall the encoding of booleans and booleans operations in lambda calculus seen in the lecture:

true  $\lambda x$  y. x false  $\lambda x$  y. y ifthen  $\lambda$ z x y. z x y  $\lambda x$ . ifthen x false true not

- (a) Define (in Isabelle) xor, the exclusive OR operator, using the definitions of ifthen and not (3 marks).
- (b) Show by beta reduction (by hand, not using Isabelle) that:

 $xor =_{\beta} \lambda x$  y. x (y false true) y then show by beta reduction that:

xor false  $y =_{\beta} y$ .

and xor true y=β程序代写代做 CS编程辅导

Each step should be a single beta reduction or definition unfolding. Alpha conversion is allowed (14 marks)

(c) Prove the above the length le, using unfold and refl. Explain (informally) what the refl theor was a why it can be used to prove the lemmas (6 marks).

3 Proposition (1974) marks)

Prove each of the following statements (after stating them in Isabelle for (c) and (f)), using only the proof methods

rule, erule, assumption, cases frule, drule, rule\_tac, erule\_tac, frule\_tac, drule\_tac, rename\_tac, and case\_tac Continue.

and using only the proof rules

impI, impE, conjI, conjE, disjI1, disjI2, disjE, notI, notE, iffI, iffE, iffD1, iffD2, ccontr, classical, FAlseE TrueL conjuncti, Princt2 and mExam Help You do not need to use all of these methods and fulls.

- (a)  $A \lor B \lor A \longrightarrow B \lor A$  (3 marks)
- (b) ( $\neg a \rightarrow b$ ) Email: tutores@163.com (3 marks)
- (c) "Saying that if Alice is here then Bob is definitely not here is the same as saying that they can't both be here"
- (d)  $(A \wedge B \vee C) = (A \vee C) / (B \vee C$
- $(e) \neg P \land Q \longrightarrow \neg (R \land P) \land (R \longrightarrow Q)$  (7 marks)
- (f) "If either it is not passible that you do not have an umbrella at a time where it is also raining." (5 marks)

### 4 Higher-Order Logic (27 marks)

Prove each of the following statements (after stating them in Isabelle for (d)), using only the proof methods and proof rules stated in the previous question, plus any of the following proof rules:

allI, allE, exI, and exE.

You do not need to use all of these methods and rules. You may use rules proved in earlier parts of the question when proving later parts.

(a) 
$$(\forall x. \neg P x) = (\nexists x. P x)$$
 (4 marks)

(b) 
$$(\forall x. B x) \lor (\forall y. A y) \longrightarrow (\forall x y. A y \lor B x)$$
 (4 marks)

(c) 
$$(\forall x \ y. \ A \ y \lor B \ x) \longrightarrow (\forall x. \ B \ x) \lor (\forall y. \ A \ y)$$
 (7 marks)

- (d) "If any proposition is true then the value True is the same as the value False." (4 marks)
- (e)  $((\exists x. A x) \longrightarrow \neg C) \longrightarrow (\forall x. B x \longrightarrow A x) \longrightarrow (\exists x. B x) \longrightarrow \neg C$  (4 marks)

(f) 
$$(\forall x. \neg R x x) \longrightarrow \neg (\forall x y. \neg R x y \longrightarrow R y x)$$
 (4 marks)