Homework 3

SUBJECT: Dennis George Part 1 Proof

DATE: / /

Φ_1 $p3 \ldots p5 \rightarrow want_p = 1$

Φ_2 $want_p = 1 \rightarrow p3 \ldots p5$

Φ_3 $p3 \ldots p5 \leftrightarrow want_p = 1$ and

$q3 \ldots q5 \leftrightarrow want_q = -1$

Φ_4 $\neg(p4 \wedge q4)$

Proof of Φ_1

Φ_1 $p3 \ldots p5 \rightarrow want_p = 1$

Base Case

$p3 \ldots p5$ is false, so Φ_1 is true

Inductive Step

1. q doesn't matter because it doesn't change pn
2. $p1 \rightarrow p2$ doesn't change Φ_1
3. $p2 \rightarrow p3$ $p3 \ldots p5$ is true and $want_p = 1$ is true $T \rightarrow T$
4. $p3 \rightarrow p4$ doesn't change $want_p$. still true
5. $p4 \rightarrow p5$ doesn't change $want_p$. still true
6. $p5 \rightarrow p1$ $p3 \ldots p5$ becomes False Φ_1 is true

Therefore Φ_1 is true

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Proof of Φ_2 (wantp = 1 → p3 ... p5)

Base Case

wantp = 1 is false so Φ_2 is true

Inductive Step

Whenever we change wantp to equal 1 in the program, be must be within p3 ... p5. Whenever wantp != 1, Φ_2 is true

Therefore Φ_2 is true

With Φ_1 and Φ_2 both being true, Φ_3 is true by deduction
Q is symmetrical to p and can be assumed to work w/ above proofs

Therefore Φ_3 is true

p3 ... p5 ↔ Wantp = 1
q3 ... q5 ↔ wantq = -1

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Proof of Φ_4 (ME)

Contradiction:
Assume $p4 \wedge q4$

case1: $p3 \to p4$, $q4$

Φ_3 gives us that wantq = -1
$p3 \to p4$ implies that wantp != wantq
in order for q to be at q4,
wantp=-1 $\wedge$ wantq = -1. This breaks Φ_3

case2: $p4$, $q3 \to q4$
Same logic as case1 but mirrored

End of proof by contradiction

Φ_4 must be true and ME is upheld