$\begin{array}{c}
O(x) \forall x (\exists w(x) \Rightarrow (S(x) \lor V(x))) \\
g) \exists x (\exists w(x) \land \exists S(x) \land \exists V(x)) \\
h) \forall x (\exists w(x) \Rightarrow (S(x) \lor V(x))) \\
\lambda) (x = Ingrid) \land S(x) \land w(x) \\
j) \exists x ((x \neq Ingrid) \Rightarrow S(x)) \\
k) \forall x ((x \neq Ingrid) \Rightarrow S(x))
\end{array}$ 

2 e) Proposition

False

For all male patients, if he had migraines, then he had fainting spells and if he had fainting spells, he had migraines.

f) Proposition

True

For all male patients, if he has migraines and has fainting spells, then he was not given the medicine

g) Proposition

True

There exists male patient such that he was given medication and he did not have fainting spells and did not have migraines.

h) Proposition

False

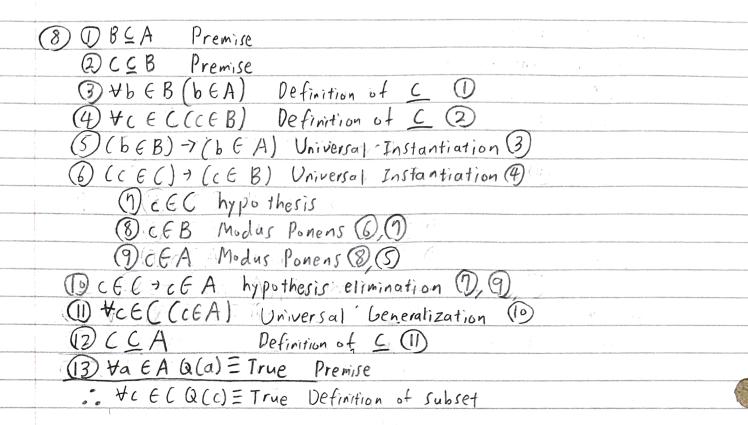
For all male patients, if he had given medicine, he either had fainting spells or had migraines.

(3) d) +x (p(x) → m(x)) Megation: TXX (P(X) -) M(X)) Apply: 3x7(P(x) +M(x)); 3x 7 (7P(x) VM(x)) [(x)M r N (x)9) XE English: There exists some patients that took the placebo and did not have migraines. e) IX(M(X) 1 P(X)1 Negation: 7 3x (M(x) n p(x)) Apply: +x 7(M(x) 1 P(x)) YX (TMIX) V TP(X)) English: Every patient was either not given placebo or did not have migraines. (4) b) 7(4x 3y ( P(x/y) 1 Q(x/y))) JX YY7 (P(X,Y)A Q(X,Y)) BX ty (7P(x,y)V7Q(x,y))

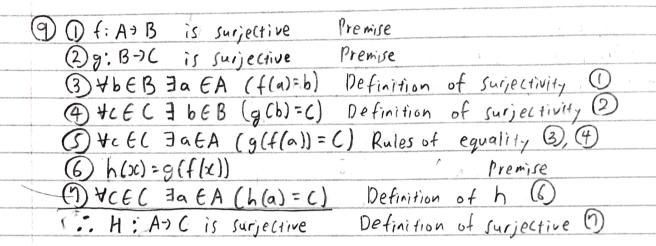
Of) tx By (y(x) g) +x =y (x+0 -7 y=支) h) +x =y+z((x+oラy=女) ハ(y+z-) z+女)) (b) f) tx ((x + Juse phine) -> B(Juse phine, x)) 9) =x+y(B(Nancy,x) A((++x)+) 7B(Nancy,y))) b) 3x 3y 3z ((x/y) 1 7 B(z,x) 17 B(z,y)) the contract of the state of no see that the said and the light of the see the and the state of the state of the state of the were one was the said of the said of the

	(1) () (x7Y) 1 (Z77) premise
	(2) JC -> Y Simplification (1)
	(3) Z>T Simplification (1)
	(4) XAZ Hypothesis
	OX Simplification (9)
	10 Z Simplification (4)
	DY Modus Ponens Q, D
er er is had.	1 Modus Ponens 3, 6 Maria Maria
-	9 YAT Conjunction (D), (8)
	: (XAZ)-(YAT) Hypothesis Elimination (4,9)
	The state of the s
	Given that x - Y and z - T (line 1), x - Y and z - T are both true (line 2&3).
	Take I and Z (line 4). Here, both I and Z are true (line 5 and 6).
	If x is true, it leads to y (line n) and if z is true, it leads
	to T (line 8). Therefore if both I and Z are true, it leads
	to both Y and T Cline 10), which can be written as:
	$(x \wedge z) \rightarrow (Y \wedge T)_{x \wedge y}$

and the second of the second



Given B is a subset of A (line 1) and ( is subset of B (line 2), every elements in B are also in A and every elements in C are also in C (lines 3-4). From this information, we can assume that if an element is in B, it is also in A and if an element is in C, it is also in B (lines 5-6). Therefore, for every elements in C, those elements are also in B and those elements in C that are also in B are also in A (lines 17-10). This means that every elements in C are in A and therefore, ( is a subset of A (lines 11-12). Since for all elements in A Q(a) is true as given (line 13), every elements in C, which are also in A, gives Q(c) True for all elements in C.



Civen that f:A7B and g:B-> ( are surjective (line 1 ard 2), there exists elements in A that correspond to every elements in B. when elements in A are put into function f (line 3) and there exists elements in B that correspond to every elements in C when elements in B are put into function g (line 4).

If we put the function f (which takes the elements of A and outputs all elements of B) as inputs of function g and put the elements of A that output all elements of B to function f, g (f(a)) will be equal to g(B), which will result in all elements of C. Since h(x) = g(f(x)) by given (line 6), function h can be written as h(a)=L for some elements in A and all elements in C. Therefore, function h is surjective.

```
10 Prove DAE = $
       4 Proof by Contradiction
           DNE= p is False = DNE + p
                             Hypothesis
Definition of \neq, \emptyset (1)
     DDNE $ $
    3 =x (x & (DnE))
        3 z E(D n E)
                               Existential Instantiation (2)

⊕(ZED) ∧(ZEE) Definition of ∩ ③

        (5) ZED
                               Simplification (4)
        @ZEE.
                               Simplification 4
       nze (()A) Definition of DO
       (8) ZEC(NB) Definition of E (5)

(9)(ZE()N(ZEA) Definition of N (9)

(10)(ZEC)N(ZEB) Definition of N (8)
                             Simplification 9
       D Z € C
                             Simplification 9
       12 ZEA
                              Simplification 19
       (B) ZEC
                             Simplification 10
       (4) ZEB
                         Conjunction (2), (4)
Premise
       ( ZE (A N B)
       (B) A n B = 8
                            Equality (1), (6)
      (11) Z \in \emptyset
      (18) ZE(GNCNC) Conjunction (1), (1)
                             Definition of Ø, 1 (18)
     (19) Z E Ø
   (20) False
   (21) =30 (XE(DNE)) > False hypothesis elimination (9) (20)
   (22) 7(3x (x(E(DnE))) V False Conditional Identity (2)
  23 7(1x(xE(D)nE)) Identity Laws (22)
24 +x (x & (D)nE)) De Morgan's Law (23)
... (D)nE) = Ø Definition of Ø
```

Suppose for the purpose of contradiction, that DNE = Ø is False. This means that DNE for (line 1). This means that there exists an element in DNE (line 2). Let z be in DNE (line 3). This means that z is in both D and E (lines 4-6). D is CNA and E is CNB by definition (lines 7-8). This means that z is in C and B (lines 9-10). Then, z is in C, z is in A, and z is in C, z is in B (lines 9-10). Then, z is in C, z is in A and B. by conjunction (line 15). However, ANB = Ø by definition (line 16), so z is in Ø (line 17). When we combine that z is in Ø, z is in C, z is in Ø by laws of N (line 18-19). Since z is in Ø, there cannot be an element z, which shows that z in DNE is false and there cannot be an element in DNE (line 20-21). Therefore, since no element is in DNE, DNE is empty set.