1 Boolean Algebra [12 points]

(a) [6 points] Find the simplest sum-of-products representation of the following Boolean equation. Show your work step-by-step.

$F = (\overline{A} + B + C).(A + B + \overline{C}).C + A$

$F = B.C + A$

Explanation:
$F = (\overline{A}.A + \overline{A}.B + \overline{A}.\overline{C} + B.A + B.B + B.\overline{C} + C.A + C.B + C.\overline{C}).C + A$
$F = (0 + B.(\overline{A} + A) + \overline{A}.\overline{C} + B + B.(\overline{C} + C) + C.A + 0).C + A$
$F = (B + \overline{A}.\overline{C} + B + B + C.A).C + A$
$F = (B.C + \overline{A}.\overline{C}.C + B.C + C.A.C) + A$
$F = (B.C + 0 + C.A) + A$
$F = B.C + A.(C + 1)$
$F = B.C + A$

(b) [6 points] Convert the following Boolean equation so that it contains only NAND operations. Show your work step-by-step.

$F = \overline{A} + \overline{(B.C + \overline{A.C})}$

$F = \overline{(A.\overline{(\overline{B.C}.\overline{A.C}.\overline{A.C})})}$

Explanation:
$F = \overline{\overline{(\overline{A} + \overline{(B.C + \overline{A.C})})}}$
$F = \overline{(A.\overline{(B.C + \overline{A.C})})}$
$F = \overline{(A.\overline{\overline{(\overline{B.C}.\overline{A.C})}})}$
$F = \overline{(A.\overline{(\overline{B.C}.\overline{A.C})})}$
$F = \overline{(A.\overline{(\overline{B.C}.\overline{A.C}.\overline{A.C})})}$