2002 Paper 2 Question 2

Digital Electronics

(*a*) Find a minimal sum of products form for each of the following partially specified boolean functions. Each partially specified function, g_i, is specified by a function f_i which is true when g_i must be true and d_i which is true when g_i may be true or false (that is, d_i represents the "don't cares").

    (*i*) $f_1 = y\,x\,\overline{w} + x\,y\,z + \overline{y}\,\overline{x}\,\overline{z}\,w + x\,w\,z$

          $d_1 = \overline{x}\,z$ [4 marks]

    (*ii*) $f_2 = y\,\overline{w}\,\overline{z} + \overline{w}\,\overline{x}\,\overline{z} + \overline{y}\,\overline{w}\,\overline{z}$

          $d_2 = \overline{x}\,w\,\overline{z}$ [4 marks]

(*b*) What is the maximum number of product terms in a minimal sum of products form of a function of n boolean variables?   [2 marks]

(*c*) How do "don't cares" arise in practice and how may they be exploited? Are there any pitfalls in using them? Illustrate your answer with examples.
                                              [10 marks]