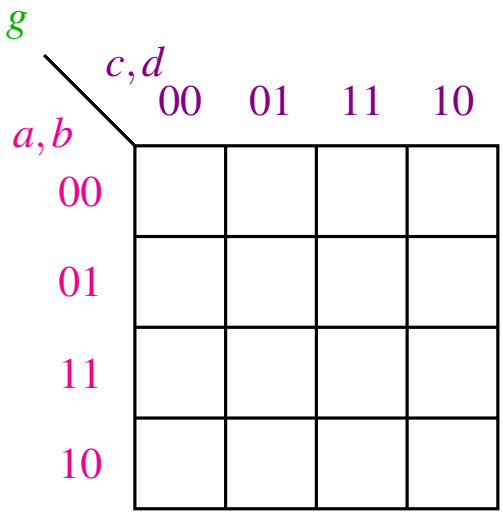
Answer ALL the questions.
Do all rough work on on the blank page included in the questions paper.
Answer on the question paper itself in the spaces provided.
There may be more blank spaces than what are minimally needed to answer the questions.

1. Simplify the following functions 25

   (a) $f(a,b,c,d) = \prod_{M}(3,6,8,9,10)$[off-set] $\cdot \prod_{D}(0,1,2,7)$[don't care set] for 2-level product-of-sum (POS) realisation (negated literals permitted).



(b) $f(a,b,c,d,e) = \sum_{m}(0,4,6,7,8,12,14,16,18,19,20,24,26,28)$ [on-set] $+ \sum_{D}(2,3,10,15,22,23,27,30)$ [don't care set] for 2-level realisation using XOR and AND gates (negated literals permitted).