SE120 - Discrete Structures II
Test 3 - Solutions
Thursday 22 April 2004, 17:00, Th1

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1. (a) $A \times B = \{(a,1),(a,2),(b,1),(b,2),(c,1),(c,2)\}$ **[1 mark]**
   (b) $A \times B \times C = \{\}$ **[1 mark]**
   (c) $R = \{(a,1),(a,2),(b,1)\}$ or any other three elements of $A \times B$ **[1 mark]**

2. (a) R is not a function because two elements exist in R that have the same first element and different second elements, for example $(0,(-2,2)) \in R$ and $(0,(3,-3)) \in R$ **[1 mark]**
   (b) One such function is $R' \subseteq (\mathbb{N} \times \mathbb{Z}) \times (\mathbb{Z} \times \mathbb{Z})$ defined as $R' = \{((a,b),(b,c)) : a \in \mathbb{N}, b,c \in \mathbb{Z}, a = b + c\}$. **[3 marks]**

3. One such language is WORDLENGTH $= \{(w,l) : w \in \{a,b\}^*, l \in \mathbb{N}, l = |w|\}$. Accepting (recognising) this language is equivalent to the problem of calculating the length of words over $\{a,b\}$. **[3 marks]**