# Homework 2 Sets Answers

1. (a) Complete the tables to show the definitions of sets.

[3]

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| **Definition** | **Set Comprehension** |
| S = {2, 3, 5, 7, 11, 13, 17, …} | S = {x | x ∈ **N** ᴧ x is prime} |
| A = {a, e, i, o, u} | A = {x | x is a letter in the English alphabet ᴧ x is a vowel} |

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| **Definition (Strings)** | **Compact Representation** |
| T = {110, 11100, 1111000, 111110000, …} | T = {1n0n-1 | n ≥ 2} |

1. Given sets: A = {0, 1} B = {1, 2}

[5]

* A ∪ B = {0, 1, 2}
* A ∩ B = {1}
* A \ B = {0}
* A x B = {(0, 1), (0, 2), (1, 1), (1, 2)}
* 3 ∈ B = False

1. In the table below, AliceCourses represents the set of courses that Alice takes, and KevinCourses represents the set of courses that Kevin takes.

e.g. AliceCourses = {French, German, History}

Write expressions showing the relationships between the given sets. The first one has been done for you. [2]

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| The set of common courses between Alice and Kevin | AliceCourses ∩ KevinCourses |
| Kevin takes courses that James takes except for the ones that Alice takes | KevinCourses = JamesCourses \ AliceCourses |
| Alice takes all the courses that are taken by either James or Kevin | AliceCourses = JamesCourses ∪ KevinCourses |

1. Given sets: A = {1, 2} B = {a, b, c}
2. Write an expression, using the cardinality symbol, that represents the cardinality of   
   A x B. Demonstrate that it works using sets A and B. [2]
   * |A x B| = |A| x |B| = 2 x 3 = 6
3. Is it true that A x B = B x A? Show your working. [3]
   * No, A x B ≠ B x A
   * A x B = { (1,a), (1,b), (1,c), (2,a), (2,b), (2,c)}
   * B x A = {(a,1), (a,2), (b,1), (b,2), (c,1), (c,2)}
   * Therefore, A x B does not equal B x A, because the resultant sets are not equivalent.
4. Given sets: ∅ A = {1} B = {1,3} C = {1,5,9} D = {1,2,3,4,5} E = {1,3,5,7,9} U={1,2,…8,9}

Complete the table to show the relationships between the sets and write your reasoning in the last column. [4]

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| **Sets** | **Relationship (⊆, ⊈, ⊂)** | **Reason** |
| ∅, A | ∅ ⊂ A  (Also accept ∅ ⊆ A) | The empty set is a proper subset of every set  (It is also a subset of A since a proper set is a subset) |
| B, C | B ⊈ C | 3 ∈ B but 3 ∉ C |
| C, E | C ⊂ E | Every member of C also exists in E and C ≠ E |
| D, U | D ⊂ U | Every member of D exists in U and D ≠ U |

1. Explain why X = {4, 6, 7, 8} is not a subset of Y = {y | y ∈ **P** Λ y MOD 2 = 0}. [1]

The member 7, belongs to set X. However, 7 MOD 2 ≠ 0, therefore, X ⊈ Y.

[Total 20 Marks]