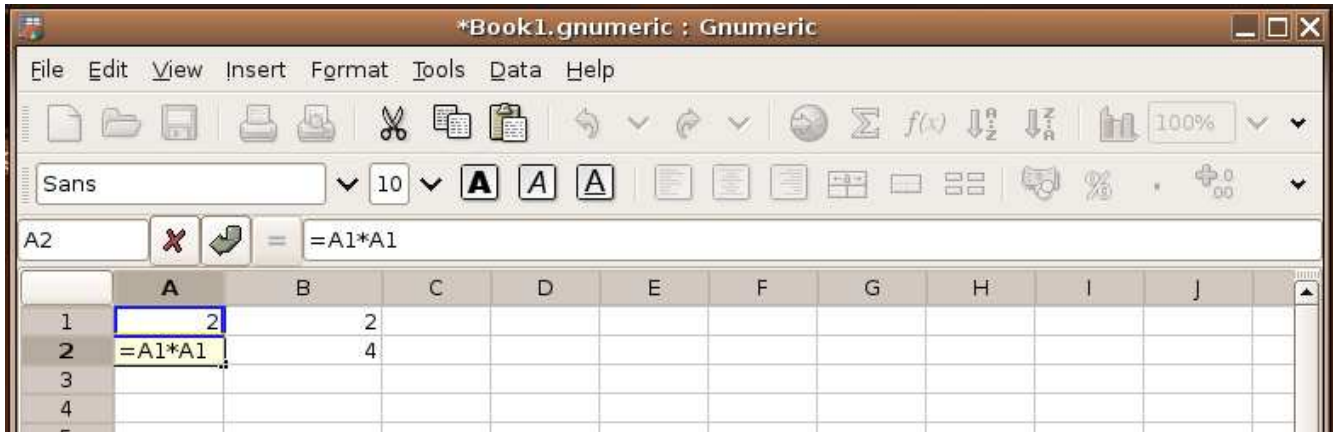


## QUESTION 1. [8 MARKS]

## PART (A) [4 MARKS]

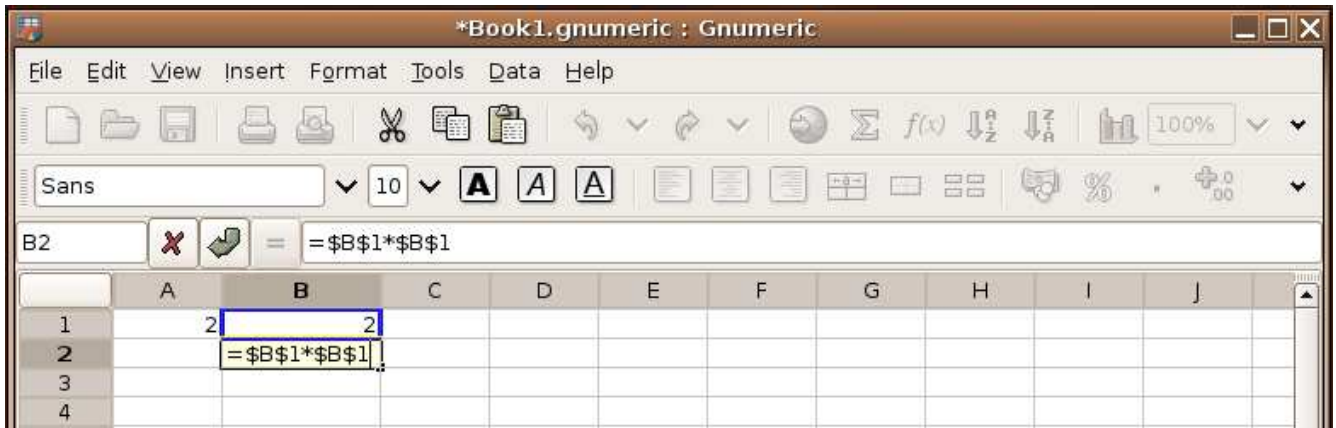
Look at the fragment of a gnumeric spreadsheet below. Notice that cell  $A2$  contains the formula  $= A1 * A1$ . Suppose you copy the formula in  $A2$  to  $A3$  and  $A4$  (using the mouse to drag the lower right corner down, or using Ctrl-C Ctrl-V). Answer the questions below:



1. What number will appear in cell  $A2$ ? Answer: 4
2. What number will appear in cell  $A3$ ? Answer: 16
3. What number will appear in cell  $A4$ ? Answer: 256
4. Explain why the formulas produce these numbers. Answer: The reference to  $A1$  in the formula is a relative reference, so when it is copied down 1 row, the row number of the reference increases. So in  $A2$  we have  $= A1 * A1$  which is 4, in  $A3$  we have  $= A2 * A2$ , which is 16, and in  $A4$  we have  $= A3 * A3$ , which is 256.

## PART (B) [4 MARKS]

Look at the fragment of a gnumeric spreadsheet below. Notice that the cell  $B2$  contains the formula  $= \$B\$1 * \$B\$1$ . Suppose you copy the formula in  $B2$  to both  $B3$  and  $B4$  (using the mouse to drag the lower right corner down, or using Ctrl-C Ctrl-V). Answer the questions below:



1. What number will appear in cell B2? Answer: 4
2. What number will appear in cell B3? Answer: 4
3. What number will appear in cell B4? Answer: 4
4. Explain why the formulas produce these numbers. Answer: The dollars signs make B\$1 an absolute reference, so in each cell we multiply 2 (the value in B\$1) times 2, which is 4.

MARKING SCHEME: One mark for each of 8 parts.

QUESTION 2. [10 MARKS]

PART (A) [2 MARKS]

What base ten number does the binary number 001010111 represent? Answer: 87

MARKING SCHEME: 2 marks for calculating 87. 1 mark for evidence of a correct attempt to calculate 87 marred by a clerical error.

PART (B) [2 MARKS]

How do you write the base ten number 41 as a binary number?

Answer: 0101001

MARKING SCHEME: 2 marks for calculating 101001 (possibly with leading zeroes on the left). 1 mark for evidence of correct attempt to calculate, marred by a clerical error.

PART (C) [4 MARKS]

Add 001010111 to 41 written as a binary number. Show your work. What is the result, in base 10? (You are welcome to use up to 9-bit numbers).

$$\begin{array}{r}
 0\ 0\ 1\ 0\ 1\ 0\ 1\ 1\ 1 \\
 +\ 0\ 0\ 0\ 1\ 0\ 1\ 0\ 0\ 1 \\
 \hline
 0\ 1\ 0\ 0\ 0\ 0\ 0\ 0\ 0
 \end{array}$$

MARKING SCHEME: 2 marks for correctly carrying out binary addition. 1 mark for evidence of correct attempt to carry out binary addition marred by a clerical error. 2 marks for correctly calculating that the base 10 equivalent is 128, 1 mark for evidence that a correct attempt at this calculation was made, but marred by a clerical error.

Result: 01000000.

PART (D) [2 MARKS]

Find the 8-digit binary number that, when added to 10010111, produces 8 zeroes (no need to worry about the carry from the left-most addition). Answer: 01101001

MARKING SCHEME: 2 marks for correctly calculating 01101001. 1 mark for something close (perhaps off by a digit).

QUESTION 3. [10 MARKS]

Examine the fragment of a gnumeric spreadsheet below. Calculate the missing values of  $37n^2 + 7n + 3$  for  $n = 2, 3, 4, 5, 6, 7, 8, 9, 10$ . Your calculations may use the entries from the spreadsheet and the addition operation (no multiplication). Show your work, which will resemble an exercise you did in tutorial.

	A	B	C	D	E	F	G	H	I	J
1	n	$37n^2 + 7n + 3$	1st diff	2nd diff						
2	0		3	44						
3	1		47	118						
4	2									
5	3									
6	4									
7	5									
8	6									
9	7									
10	8									
11	9									
12	10									
13										

Solution: Suppose  $n$  is the row number. For cell  $C_n$  you add  $C(n - 1) + D(n - 1)$ , the previous second difference to the previous first difference. For cell  $B_n$ , you add  $B(n - 1) + C(n - 1)$ , the previous first difference to the previous value of  $37n^2 + 7n + 3$ . The completely filled-in table looks like:

	A	B	C	D	E	F	G	H	I	J
1	n	$37n^2 + 7n + 3$	1st diff	2nd diff						
2	0	3	44	74						
3	1	47	118	74						
4	2	165	192	74						
5	3	357	266	74						
6	4	623	340	74						
7	5	963	414	74						
8	6	1377	488	74						
9	7	1865	562	74						
10	8	2427	636	74						
11	9	3063	710	74						
12	10	3773								
13										

MARKING SCHEME: 10 marks for calculating  $B2 - \dots - B10$ . 9 marks for calculating  $B2 - \dots - B10$ , marred by a clerical error. 8 marks for indicating how to calculate column  $B$ , with a couple of examples. 5 marks for calculating a few entries, without indicating the method used. 3 marks for directly calculating the polynomial  $37n^2 + 7n + 3$  (which involves multiplication).

QUESTION 4. [5 MARKS]

PART (A) [2 MARKS]

Suppose you typed three English words into the Google search engine, with the aim of getting as few hits as possible. What principles would guide your choice of the three words?

Solution: I would try to choose words that had no connection with each other, so that the chance that they appear in the same web page is very small.

MARKING SCHEME: One mark each for unusual words and unrelated words. The use (or omission) of + symbols doesn't really indicate how you would choose words. The aim here was to get as few pages as possible, not (necessarily) to effectively search for a given topic.

PART (B) [3 MARKS]

What sort of web pages would you expect Google's search to turn up, even though you apply the principles described in the previous part?

Solution: Some pages have huge lists of English words, or lists of rhyming words, so just about any choice of 3 English words will be contained in such a page.

MARKING SCHEME: One mark each (up to a total of 3) for large sites, sites that include all three words, large lists of words, lists of rhyming words. Describing the output of Google search doesn't really describe the sort of pages you would expect.

Total Marks = 33

Student #: \_\_\_\_\_

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END OF SOLUTIONS