The University of New South Wales

**SAMPLE** Final Examination

Semester 1, 2013

**ENGG1811 Computing for Engineers**

Time allowed: **2 hours**
Reading time: **10 minutes**
Total number of questions: **48, in 3 Sections**
Total number of marks: **100**
No examination materials permitted
Calculators may **not** be used
Questions are **not** worth equal marks
Answer **all** questions except where noted in Section C
A table of VBA functions is included on the back cover
This paper may **not** be retained by the candidate

**Answers must be written in ink. Except where they are expressly required, pencils may be used only for drawing, sketching or graphical work.**
Section A: Multiple Choice Questions

Answer the questions in this section on the answer sheet provided, NOT on this paper.

Each question has four alternatives. Once you have chosen an alternative, fill in the selected letter (e.g., "B") against the question number on the multiple-choice sheet. Be careful that you fill each answer in on the correct row of the multiple-choice sheet, and erase any stray marks.

Each question in this section is worth 1 (one) mark. There is no additional penalty for answering a question incorrectly. It is recommended that you spend no more than 40 minutes on this section.

A1. What of the following applies to point-to-point communication?
   A) It has one transmitter and one receiver
   B) It has one transmitter and many receivers
   C) It has many transmitters and one receiver
   D) It has many transmitters and many receivers

A2. Which of the following statements about the binary sequence 01101101 is false?
   A) It represents a byte of data
   B) It has even parity
   C) It could be used to encode a single ASCII character
   D) When XORed with 11111111 it produces 10010010

A3. Suppose that in a MS Excel spreadsheet cells A1, B1 and C1 contain the values 2, 3, and 4 respectively. What value will be displayed in a cell containing the formula
    \[(A1+C$1)/$A$1+B1\]
   A) 2
   B) 4
   C) 6
   D) the formula is invalid

A4. Suppose you want to design a query in a MS Access database that requests input from the user when the query is run, and then displays records selected on the basis of the user’s input. What kind of query would you use?
   A) Action query
   B) Append query
   C) Parameter query
   D) Question query
A5. Consider the following portion of a MS Excel worksheet.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>2</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>5</td>
<td>8</td>
<td>7</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Suppose that cell E4 contains the formula =B2+C3 and that this cell is now copied to cell D5. What value will be shown in cell D5?

A) 9
B) 10
C) 14
D) 16

A6. Which of the following is not a valid formula when typed into the cell L5 in a MS Excel worksheet?

A) =AVERAGE(D6:D11)
B) =AVERAGE(A$1:B4, D2:$E$5)
C) =AVERAGE(A2:10D)
D) =AVERAGE(A2)

A7. Which one of the following statements is false?

A) Firewalls are used to protect computers from fire.
B) Cluster computing uses hardware of generally uniform type.
C) Synchronous communication requires both sender and receiver are active at the same time.
D) IP packets (of the same message) may take different routes across the Internet.

A8. In MS Excel, the Histogram tool can be used to…

A) display historical commands.
B) display historical calculations.
C) calculate and display correlations between two or more variables.
D) None of the above.
A9. Consider the following portion of a MS Excel worksheet.

![Excel Spreadsheet](image)

Suppose that cell C1 contains the formula `=IF($B$1>35,"Hot","Cool")` and that this cell is now copied to cell C2. What value will be shown in cell C2?

A) Hot  
B) Cool  
C) Error  
D) None of the above

A10. In MS Access, which one of the following statements is true for the wildcard character * (asterisk)?

A) It matches 1 or more characters.  
B) It matches 0 or more spaces.  
C) It matches 0 or more strings.  
D) It matches 0 or more characters.

A11. Which one of the following statements is true?

A) IP addresses are of the form user@domain.  
B) Cloud computing has no outstanding security issues.  
C) Cloud computing clients generally do not need local hardware except internet-connected PCs equipped with a web browser.  
D) Embedded systems often do not have real-time constraints.

A12. Which one of the following statements is true?

A) RFID tags require laser scanning.  
B) A passive RFID tag does not use an antenna.  
C) An active RFID tag does not require a power source.  
D) Normally passive RFID tags store ID numbers.

A13. The original version of ASCII used,

A) 4-bit code  
B) 7-bit code  
C) 8-bit code  
D) 16-bit code
A14. A database consists of two tables called Table1 and Table2. Table1 has two fields, which are denoted by X and Y. Table 2 has four fields, which are denoted X, A, B and C. Note that the field X is common to both tables. The field X is a primary key of Table 1. Which of the following statement is true?

A) If the relationship between Table1 and Table2 is one-to-one, then X can be a primary key of Table 2.
B) If the relationship between Table1 and Table 2 is one-to-many, then X can be a primary key of Table 2.
C) If the relationship between Table1 and Table 2 is many-to-many, then X can be a primary key of Table 2.
D) None of the above.

A15. Which of the following is a valid VBA identifier:

A) 2Difficult
B) Cat-Tail
C) IAm18YearsYoung
D) _FunkyIdentifier

A16. In analog to digital conversion, which sampling parameter(s) most affect the accuracy of the digital representation?

A) sampling rate only
B) both sampling rate and compression
C) both quantisation and aliasing
D) both sampling rate and quantisation.

A17. Enforcing data types while designing a database helps us to:

A) avoid possible data entry errors
B) reduce redundancy in a database
C) save data types for future use
D) none of the above

A18. In database design, which of the following is the reason why multiple tables are sometimes used instead of a single table?

A) Multiple tables can be distributed across different computers
B) Data may be duplicated many times in a single table which increases likelihood of error
C) Both (A) and (B)
D) None of the above.

A19. Which one of the following statements about Web Services is true?

A) Web Services require specialised local hardware
B) Web Services are only available on the Windows platform
C) Web Services offer services in a human readable form
D) Web Services offer services in a machine readable form
A20. Which one of the following statements about embedded systems is false?

A) embedded systems use general purpose computers to provide a wide range of functions
B) embedded systems must be reliable enough to run continuously for a long time without error
C) embedded systems often have real-time performance constraints
D) software for embedded systems is usually stored in flash or similar memory

A21. Which one of the following statements is true?

A) forward chaining starts with outcomes and tries to find possible causes for the outcomes.
B) expert systems tend to cover a wide area of expertise in many domains
C) decision trees are used in some machine learning algorithms
D) it’s easy to acquire tacit knowledge

A22. Which of the following strings does match the pattern "[!JFMA]??*[89]" used with the Like operator in VBA or in MS Access queries?

A) Jan1988
B) February 1989
C) December 2008
D) Nov 1980

A23. Data travels from one location to another within the computer on an electronic pathway or circuit called:

A) a router
B) a video driver
C) an output port
D) a data bus

A24. Which one of the following statements is true?

A) 1 terabyte = 1000 gigabytes
B) 1 terabyte = 1024 gigabytes
C) 1 terabyte = 1000 petabytes
D) 1 terabyte = 1024 petabytes

A25. Which one of the following statements is true?

A) The Internet uses broadcast communication only
B) IP packets, of the same message, must follow the same route across the Internet
C) The Ethernet protocol was designed for wide area networks
D) None of the above is true
A26. Which one of the following statements is true?
   A) A symmetric secret key system uses the same key for every user.
   B) A symmetric secret key system needs to generate a new symmetric key every time a user wants to encrypt a message.
   C) The biggest problem with symmetric secret key system is key management.
   D) A symmetric secret key system needs initial handshake (using PKI), before encrypting a message.

A27. In MS Excel, the Correlation tool can be used to …
   A) calculate the strength of linear relationship between two or more variables
   B) calculate a frequency distribution
   C) display Trendlines
   D) calculate an optimal solution

A28. Suppose that in a MS Excel spreadsheet, cell B2 contains the value 115, and cell C2 contains the value 34. What value will be displayed in a cell containing the following formula?

   \[ \text{=IF(AND(B2<0, B2>100), "Error", IF(B2<50, "Fail", "Pass"))} \]

   A) Error
   B) Fail
   C) Pass
   D) none of the above

A29. The following table lists the arithmetic operators used in Visual Basic for Applications (VBA), in decreasing order of precedence.

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>()</td>
<td>()</td>
</tr>
<tr>
<td>^</td>
<td>unary: sign</td>
</tr>
<tr>
<td>+, -</td>
<td>(unary: add, subtract)</td>
</tr>
<tr>
<td>*, /</td>
<td>(binary: add, subtract)</td>
</tr>
<tr>
<td>\</td>
<td></td>
</tr>
<tr>
<td>Mod</td>
<td></td>
</tr>
<tr>
<td>+, -</td>
<td>(binary: add, subtract)</td>
</tr>
</tbody>
</table>

What is the value of this constant expression?

   \[ 4 * 3 ^ 2 / 2 \]

   A) 6
   B) 12
   C) 18
   D) 72
A30. Which of the following statements about **ByRef** and **ByVal** is false?

A) If neither keyword is specified, **ByVal** is assumed  
B) **ByRef** and **ByVal** are only used in procedure parameter lists  
C) Variables passed by reference can be changed by the procedure  
D) A parameter prefixed by **ByVal** is initialised from the value of the argument

A31. We want to count the number of sheets in the active workbook whose names begin with *Temp*, using a **For** statement of the form:

```
Dim wks As Worksheet  
Dim numTemps As Integer  
numTemps = 0  
For _______________  
   If wks.Name Like "Temp*" Then  
      numTemps = numTemps + 1  
   End If  
Next wks
```

What is the correct first line of the **For** statement for the algorithm to work?

A) **For** wks = 1 To ActiveWorkbook.Sheets  
B) **For** Each wks In ActiveWorkbook.Sheets  
C) **For** wks = 1 To ActiveWorkbook.Sheets(Count)  
D) **For** Each wks = 1 To ActiveWorkbook.Sheets.Count

A32. What are the values of *x* and *y* after this **While** loop terminates? *x* and *y* are variables of type **Integer**.

```
x = 0: y = 0  
While x < 5  
   x = x + 1  
   y = x + y  
Wend
```

A) *x* = 4, *y* = 10  
B) *x* = 5, *y* = 10  
C) *x* = 5, *y* = 15  
D) *x* = 6, *y* = 21

A33. If **blnA** and **blnB** are Boolean variables, which expression is equivalent to **Not** (**blnA** Or **Not** **blnB**)

A) **Not** **blnA** Or **Not** **blnB**  
B) **Not** **blnA** Or **blnB**  
C) **Not** **blnA** And **Not** **blnB**  
D) **Not** **blnA** And **blnB**
A34. Which of these statements about tail recursion is true?
   A) Tail recursion only applies to functions, not subprograms.
   B) Tail recursion occurs when there are multiple recursive calls in a function.
   C) Tail recursion can be replaced by iteration to produce equivalent results.
   D) The recursive definition of the Fibonacci sequence can be directly expressed using tail recursion.

A35. Which of the following statements about the Step keyword in VBA is false?
   A) Step is only used with For statements.
   B) Step indicates how much a loop control variable changes at the end of each iteration.
   C) Step must have a positive step amount.
   D) If Step and the amount are omitted, the step amount is assumed to be one.

A36. Which of the following programming structures does the Macro Recorder never produce?
   A) Iteration
   B) Subprograms
   C) With statements
   D) The Selection object
Section B: Short Answer Questions

Answer the 8 questions (totalling 24 marks) in this section using the space provided on this pink question paper, NOT in the answer book.

Tick this box ☐ if you understand where to write your answers to Section B.

In this section, questions are not worth equal marks. The marks for each question are indicated after the question number. You should aim to spend about 30 minutes on this section (about 1 minute per mark).

B1.  (2 marks) Describe the two most important advantages of using Distributed/Grid Computing.

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________________________________________________________________
________________________________________________________________
________________________________________________________________

B2.  (2 marks) Briefly outline two applications of Public Key systems.

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________________________________________________________________
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________________________________________________________________

B3.  (4 marks) Explain the difference between the concepts of “Expert Systems” and “Machine Learning Systems”, in Artificial Intelligence.

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________________________________________________________________
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________________________________________________________________
B4. **(2 marks)** Provide two major differences between sequential computing and parallel computing.

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________________________________________________________________
________________________________________________________________
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B5. **(2 marks)** In MS Excel, what does the tool named “Descriptive Statistics” offer?

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________

B6. **(6 marks)** You have been asked to develop a spreadsheet to store and analyse marks for students in a given course. You need to store the following marks for each student in a course: Assignment_1, Assignment_2 and Exam. Assignment_1 and Assignment_2 marks are out of 25 each, and Exam marks are out of 50. Assume that there are 30 students in the course.

You need to do the following analysis:

- Calculate Total marks using the following formula:
  \[
  \text{Total} = \text{Assignment}_1 + \text{Assignment}_2 + \text{Exam}
  \]
- Find the top 10 students, based on Total marks
- Find students whose Exam marks are greater than the average Exam marks for the entire class.

Draw a diagram illustrating the design of your spreadsheet application. Indicate any formulas or features of MS Excel that you would use.
(space for B6 solution)
B7.  *(3 marks)* Consider the following function, which is intended to determine whether the values in two columns of data (down to the first empty cell in both columns) are identical or not. It has one syntax error (that Debug/Compile would find), one semantic error that prevents the function from returning anything and one logical error. Identify each error and describe it very briefly.

```
Function SameData(col1 As Integer, col2 As Integer) As Boolean
    Dim row As Integer ' current row

    row = 1
    While ActiveSheet.Cells(row, col1) <> ""
        If ActiveSheet.Cells(row, col2) <> "" Then
            SameData = False ' end of col2 data
            Exit Function
        Else If ActiveSheet.Cells(row, col2) <> _
            ActiveSheet.Cells(row, col1) Then
            SameData = False
            Exit Function
        End If
        row = row + 1
    Wend
    End Function
```

Error 1 (syntax): ______________________________________________________
Error 2 (semantic): ____________________________________________________
Error 3 (logical): _____________________________________________________
B8. (3 marks) Assume the active worksheet contains a square matrix of numbers in the upper left corner similar to that shown below. Complete the statements below. They are intended to find the largest value in any cell on the major diagonal (these cells are shown shaded: A1, B2, C3 etc), and assign it to the variable diagmax.

The first empty cell on the diagonal (in this case F6) terminates the process.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>29</td>
<td>49</td>
<td>49</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>79</td>
<td>36</td>
<td>67</td>
<td>77</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>95</td>
<td>59</td>
<td>28</td>
<td>89</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>18</td>
<td>83</td>
<td>68</td>
<td>96</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>31</td>
<td>20</td>
<td>10</td>
<td>16</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>F</td>
</tr>
</tbody>
</table>

Answer (fill in the two missing lines):

```
Dim rowcol As Integer
Dim diagmax As Double
rowcol = 1
diagmax = ActiveSheet.Cells(rowcol, rowcol)
While _______________________________
  If _______________________________ Then
    diagmax = ActiveSheet.Cells(rowcol, rowcol)
  End If
  rowcol = rowcol + 1
Wend
```
Section C: Programming Questions

Answer the questions in this section in the answer book provided.

This section is worth 40 marks. Answer Question C1 and any other 2 questions only. C1 is worth 20 marks, C2 to C4 are each worth 10 marks, so it doesn’t matter which two of these you attempt.

C1. This question is related to Assignment 1, and is compulsory.

An aircraft is travelling at a constant horizontal speed of speedHorizontal, measured in km/hr. The aircraft is currently at an altitude of altitudeCurrent (in km) and has an upward (constant) vertical speed of speedVertical (in km/hr).

The pilot wants the aircraft to have an altitude within the closed interval of [lowerAltitudeLimit, upperAltitudeLimit] after the plane has travelled a horizontal distance of distanceHorizontal. The quantities lowerAltitudeLimit, upperAltitudeLimit and distanceHorizontal are all measured in km.

Write a VBA function which determines whether the altitude after travelling distanceHorizontal is in the right interval or not. The function, specifies below, accepts six inputs and returns a string.

```vba
Function ClimbCheck(speedHorizontal As Double, _
                     speedVertical As Double, altitudeCurrent As Double, _
                     lowerAltitudeLimit As Double, upperAltitudeLimit As Double, _
                     distanceHorizontal As Double) As String

    If the altitude of the aircraft after travelling distanceHorizontal is in the closed interval [lowerAltitudeLimit, upperAltitudeLimit], then the function should return the string "In the right interval"; otherwise it should return "Not in the right interval".
```


C2. Data has been collected from two measuring devices $D_1$ and $D_2$, but the values have been interleaved and placed into the first column of a worksheet. That is, the first $D_1$ value is in cell A1, the first $D_2$ value in cell A2, then the second $D_1$ value in A3, the second $D_2$ value in A4, the third $D_1$ value in A5 and so on.

Write a VBA macro (a subprogram with no parameters) that splits the data in the first column of the active sheet back into separate columns, with $D_1$ data copied to column B and $D_2$ data to column C. Assume there are equal numbers of measurements for each device, and that the first empty cell on an odd-numbered row ends the list of measurements.

The pictures show a sample worksheet before and after the subprogram is called: there may be more or fewer numbers than the 10 shown here. Declare constants for the column numbers and starting row (=1).
C3. Many functions can be approximated by their Taylor Series expansion. The expansion of $\sin x$ is given by the formula

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + ...$$

For example, this is the approximation using the first four terms of the formula:

Write a VBA function that approximates $\sin x$ using a fixed number of initial terms of the series as specified by a parameter. \textit{Hint:} consider how each term is derived from the previous one.

C4. Write a VBA subprogram that draws a thin red cross using the two diagonal borders in all empty cells in row 1 of the active sheet. Your subprogram should consider all 256 columns (the maximum for a compatible-format worksheet).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To help you to complete this task, this is what the Macro Recorder saves when the user puts a red border to the left of cell E15:

```vba
Range("E15").Select
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
With Selection.Borders(xlEdgeLeft)
  .LineStyle = xlContinuous
  .Color = -16776961
  .TintAndShade = 0
  .Weight = xlThin
End With
Selection.Borders(xlEdgeTop).LineStyle = xlNone
Selection.Borders(xlEdgeBottom).LineStyle = xlNone
Selection.Borders(xlEdgeRight).LineStyle = xlNone
```

Your subprogram should manipulate the cells directly rather than using the `Selection` object.
## Table of VBA Functions

<table>
<thead>
<tr>
<th>Function call</th>
<th>Returns…</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>Int(num)</code></td>
<td>Largest integer ≤ num</td>
</tr>
<tr>
<td><code>Fix(num)</code></td>
<td>num with fraction removed (truncates towards zero)</td>
</tr>
<tr>
<td><code>Abs(num)</code></td>
<td>Absolute value of num (same type)</td>
</tr>
<tr>
<td><code>Val(str)</code></td>
<td>Numeric data in str converted to Double</td>
</tr>
<tr>
<td><code>Round(val, dp)</code></td>
<td>val rounded to dp decimal places (Double)</td>
</tr>
<tr>
<td><code>CStr(num)</code></td>
<td>num as a string</td>
</tr>
<tr>
<td><code>CInt(arg)</code></td>
<td>arg (number or string) as an integer, fraction truncated</td>
</tr>
<tr>
<td><code>Sqr(num)</code></td>
<td>Square root of num</td>
</tr>
<tr>
<td><code>Exp(num)</code></td>
<td>$e$ raised to the power of num</td>
</tr>
<tr>
<td><code>Log(num)</code></td>
<td>Natural logarithm of num</td>
</tr>
<tr>
<td><code>Sin(a)</code></td>
<td>Sine of a in radians</td>
</tr>
<tr>
<td><code>Cos(a)</code></td>
<td>Cosine of a in radians</td>
</tr>
<tr>
<td><code>Tan(a)</code></td>
<td>Tangent of a in radians</td>
</tr>
<tr>
<td><code>Atn(r)</code></td>
<td>Arctangent of r (returns radians)</td>
</tr>
<tr>
<td><code>IsNumeric(v)</code></td>
<td>True if v can be interpreted as a number (or the empty string)</td>
</tr>
<tr>
<td><code>Rnd()</code></td>
<td>Next pseudo-random number between 0 and 1</td>
</tr>
<tr>
<td><code>WorksheetFunction.func(…)</code></td>
<td>Function func as used in Excel formulas</td>
</tr>
</tbody>
</table>

## Some Excel Object Model Examples

<table>
<thead>
<tr>
<th>Object</th>
<th>Refers to…</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>ActiveCell</code></td>
<td>The active cell, unique</td>
</tr>
<tr>
<td><code>ActiveSheet.Cells(row, col)</code></td>
<td>Cell at given row and column</td>
</tr>
<tr>
<td><code>ActiveSheet.Range(str)</code></td>
<td>Cell or range with address or name str</td>
</tr>
<tr>
<td><code>ActiveSheet.Rows(row)</code></td>
<td>Complete row</td>
</tr>
<tr>
<td><code>ActiveSheet.Columns(col)</code></td>
<td>Complete column</td>
</tr>
</tbody>
</table>

END OF PAPER