1 Programming in C and C++ (djg11)

(a) (i) In programming languages in general, what is the difference between statically and dynamically-allocated variables? Without using the static keyword, give examples of both types of variable in the C language. [2 marks]

(ii) What effect do the static and extern keywords have in C for both forms of variable? [3 marks]

(b) There are 32 characters in the ASCII set between ‘A’ and ‘a’. All are printable. A potentially-infinite stream of 8-bit bytes can be made printable by encoding into base 32 and represented by a longer stream just using these characters. Give a syntactically-accurate definition in C for encode32(unsigned char a), called for each byte, which invokes putchar(char c) once or twice per call to render the encoded output. [5 marks]

(c) Show how the for statement in C can be used to traverse a linked list. Explain the benefits of this coding style, mentioning whether the continue statement works appropriately. [4 marks]

(d) typedef char * mystring;
mystring s201 = "201";
mystring s202 = s201;
s202[2] += 1;

A novice programmer writes the above code. What do you think they are intending to do and what two problems might they suffer? [2 marks]

(e) An interpreter for a string processing language is written in C. Describe four storage and efficiency-related considerations when designing the module for storing strings for the interpreter? [4 marks]