Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on a separate sheet of paper.

1. zyBooks 7.1.1 (a), (b), (f), and (g).

2. zyBooks 7.2.1

3. zyBooks 7.3.1 (a), (b), (e), (f), and (g).

4. zyBooks 7.3.1 (a), (b), (e), (f), and (g).

5. zyBooks 7.3.2 (a), (b), (c)

6. zyBooks 7.3.3

Consider the following algorithm for counting the triangles in a *symmetric, non-reflexive* graph.

Algorithm 1: Triangle counting

Input: An $n \times n$ *adjacency matrix* called A, of a *symmetric, non-reflexive* graph G
Result: The number of triangles in G

```
/* triu(A) is A with only those edges (x,y) where x ≤ y.                     */
U ← triu(A)

/* U.' is the transpose of U and U ∗ U.' is matrix multiplication.           */
B ← U ∗ U.'

/* U ∘ B is the Hadamard product, which is similar to matrix addition, but multiplies
   rather than adds corresponding elements.                                    */
T ← U ∘ B

/* nnz(T) is the number of ones in T.                                          */
return nnz(T)
```

7. Analyze the algorithm `Triangle counting` and express the total number of additions, multiplications, and comparisons required for an $n \times n$ matrix as a function of n.

8. Prove that this algorithm is $\Theta(n^3)$.