1. Answer each as True or False and provide justification:
   (a) \( x^5 + 10x + 50 = x^5 \)
   (b) \( x^2 = o(x^2) \)
   (c) \( \log x = \omega(x) \)
   (d) \( x \log x = O(x^2) \)
   (e) \( x \log x = o(x^2) \)
   (f) \( n! = o(n^n) \)
   (g) \( n! = \omega(n^2) \)
   (h) \( x2^x = O(2^x) \)
   (i) \( x2^x = \Theta(2^x) \)
   (j) \( 1/x = O(1) \)
   (k) \( 1/x = o(1) \)
   (l) \( 1/x^2 = o(1/x) \)

2. Write the runtime of the algorithm as a precise function, \( T(n) \) and give the tightest asymptotic estimate that you can:
   1: \textbf{function} \( A(n) \)
   2: \( S := 0 \)
   3: \( i := 0 \)
   4: \textbf{while} \( i < n^2 \) \textbf{do}
   5: \( s := s + i \)
   6: \( i := i + 2 \)
   7: \textbf{end while}
   8: \textbf{end function}

3. Write the runtime of the algorithm as a precise function, \( T(n) \) and give the tightest asymptotic estimate that you can:
   1: \textbf{function} \( B(n) \)
   2: \( S := 0 \)
   3: \( i := 0 \)
   4: \textbf{while} \( i < n^2 \) \textbf{do}
   5: \( s := s + i \)
   6: \( i := i + 2 \)
   7: \textbf{end while}
   8: \textbf{end function}
4. Write the runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that you can:

```python
1: function C(n)
2:   $S := 0$
3:   $i := 0$
4:   while $i < n$ do
5:     $s := s + i$
6:     $i := i + 4$
7:   end while
8: end function
```

5. Write the runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that you can:

```python
1: function D(n)
2:   $S := 0$
3:   $i := 0$
4:   while $i < n^2$ do
5:     $s := s + i$
6:     $j := i$
7:     while $j > 0$ do
8:       $s := s/2$
9:       $j := j - 5$
10:   end while
11:   $i := i + 2$
12: end while
13: end function
```

6. Write the runtime of the algorithm as a precise function, $T(n)$ and give the tightest asymptotic estimate that you can:

```python
1: function E(n)
2:   $S := 0$
3:   $i := 0$
4:   while $i < n^3$ do
5:     $s := s + i$
6:     $j := i$
7:     while $j > 0$ do
8:       $s := s/2$
9:       $j := j - 5$
10:   end while
11:   $i := i + 2$
12: end while
13: end function
```