4.1 [25 points] Which statement for the time complexity ($T_n$) of the program is true ____

F1($n$, $p$, $r$)

$S = 0$.
For $i = 1, \ldots, n$
$S = S + F2(r, i)$.
$S = S + F2(r, i)$.
Return $S$
End

F2 ($r$, $i$)

$P = 1$.
For $j = i, \ldots, 1$
$P = P \times r$.
Return $P$
End

(a) $T_n(F1)$ is both $\Theta(n^2)$ and $\Theta(2n^2)$
(b) $T_n(F1)$ is $\Theta(n^2)$, but not $\Theta(2n^2)$
(c) $T_n(F1)$ is both $\Theta(n)$ and $\Theta(2n)$
(d) $T_n(F1)$ is $\Theta(n)$, but not $\Theta(2n)$
(e) none of the above

4.2 [25 points] A digraph $G=(V,E,\varphi)$ with $V = \{1, 2, 3, 4\}$, $E = \{a, b, c, d, e, f\}$ and $\varphi = \left(\begin{array}{cccccc}
a & b & c & d & e & f \\
(1,2) & (2,1) & (1,4) & (3,2) & (3,4) & (4,3)
\end{array}\right)$. Which statement for the graph is NOT true? ____

(a) b, c, f, d is a directed path
(b) b, c, f, d is a directed trail
(c) b, c, f, d is a directed walk
(d) a, b, c, f, e is a directed trail
(e) a, b, c, f, e is a directed walk
4.3 [25 point] A simple graph (loops are allowed) $G = (V, E)$ with $|V| = 25$ and its connected component number is 5. What is the minimal and maximal edge number it could have?

4.4 [25 point] Get all minimal weight spanning tree(s) of the graph. In the graph, the letters are vertices of the graph and the numbers are weights of the edges. You can either write the result(s) by drawing graph figure(s) or writing the graph definition(s).