

## Week 1:

### Question1:

```
module q1(a,b,c,f1,f2);
```

```
input a,b,c;
```

```
output f1,f2;
```

```
//f1
```

```
and(h1, a, ~c);
```

```
and(h2, b, c);
```

```
and(h3, ~b, ~c);
```

```
or(f1, h1, h2, h3);
```

```
//f2
```

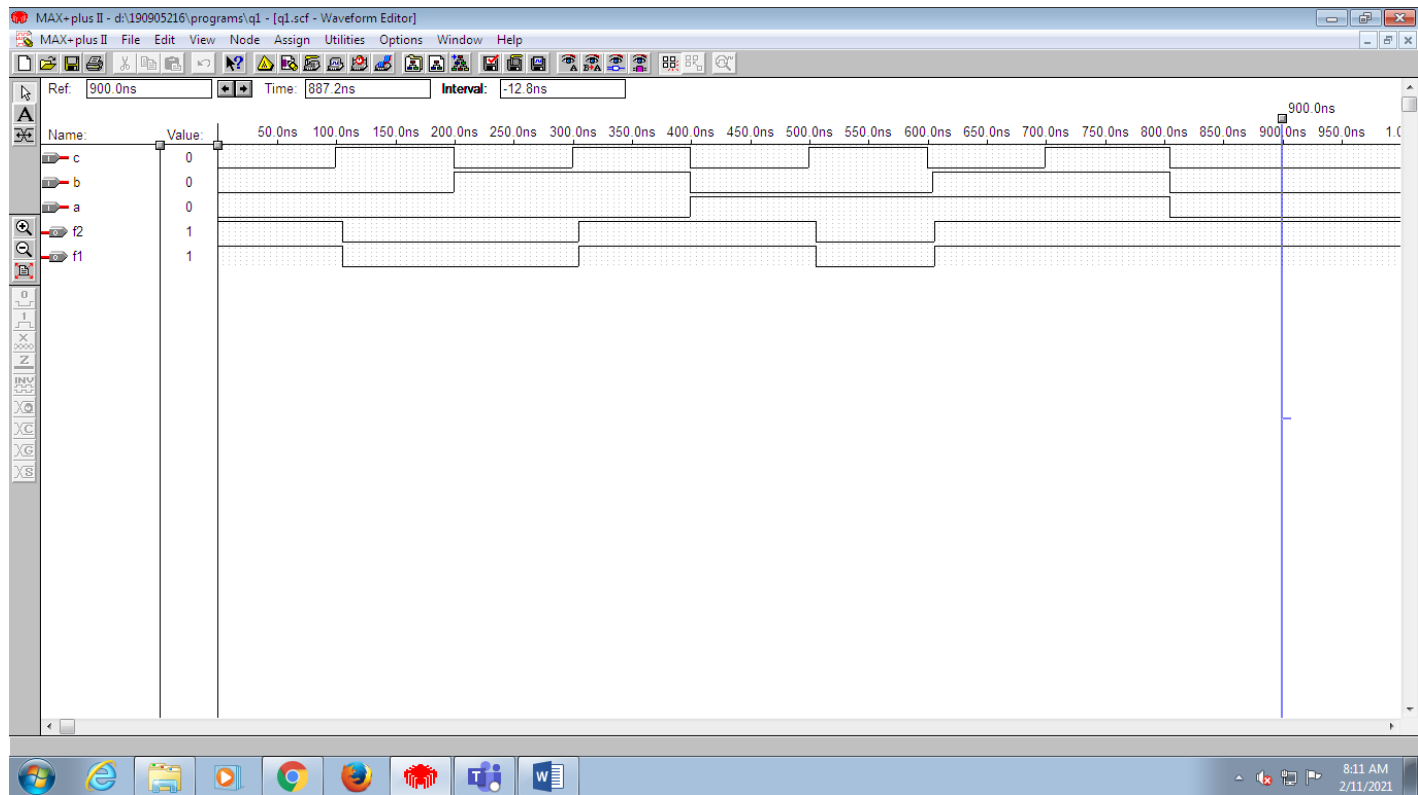
```
or(g1, a, ~b, c);
```

```
or(g2, a, b, ~c);
```

```
or(g3, ~a, b, ~c);
```

```
and(f2, g1, g2, g3);
```

```
endmodule
```



From the waveforms, it's clear that f1 and f2 are equivalent

### Question 2a:

On K-map simplification, we get,  $F = B'C'D' + B'D + B'C$

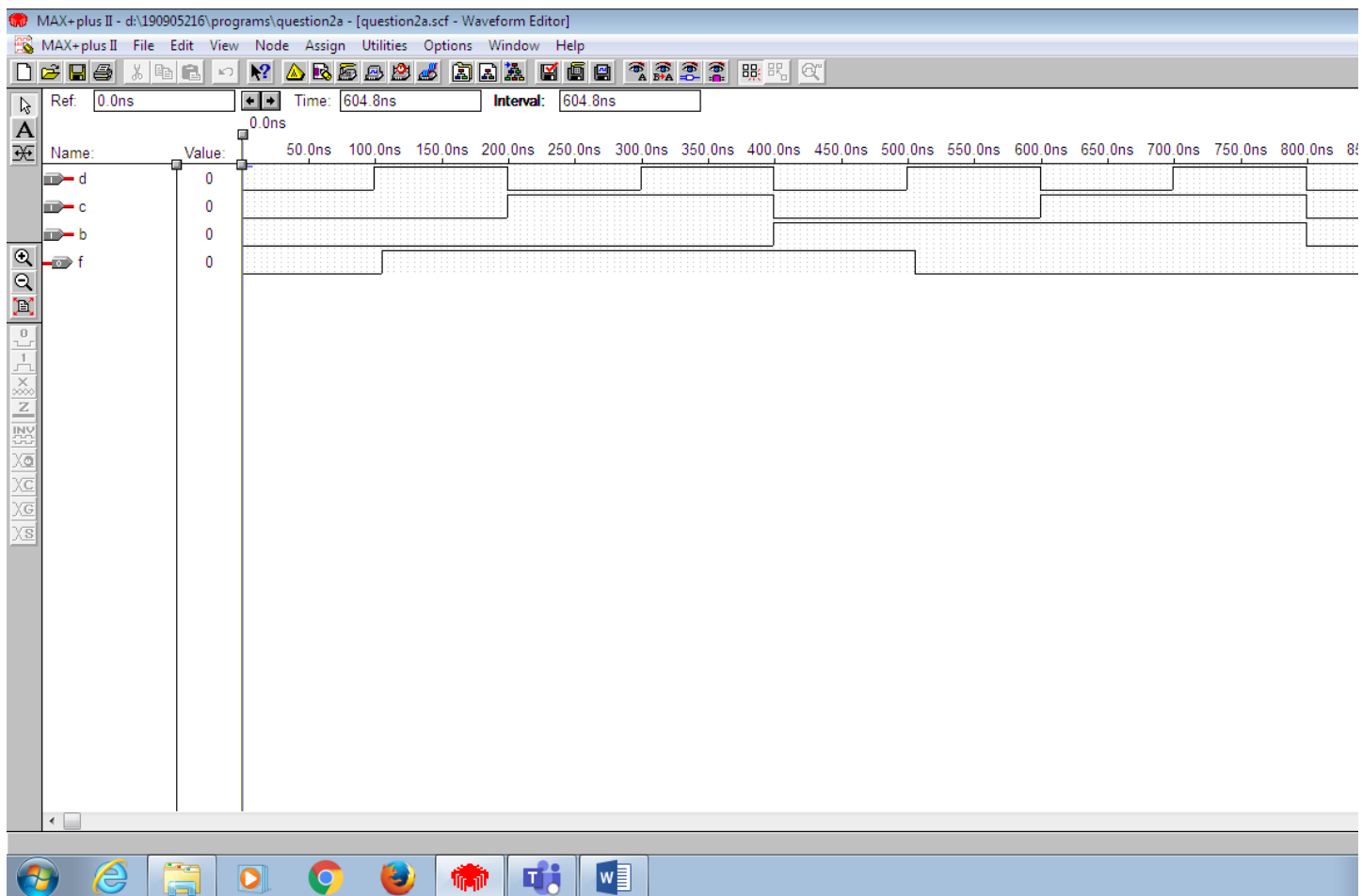
```
module question2a(a, b, c, d, f);
```

```
input a, b, c, d;
```

```
output f;
```

```
assign f = (b & ~c & ~d) | (~b & d) | (~b & c);
```

```
endmodule
```



**Question 2b:**

On K-map simplification, we get,  $F = B'C'D' + ABC + A'D$

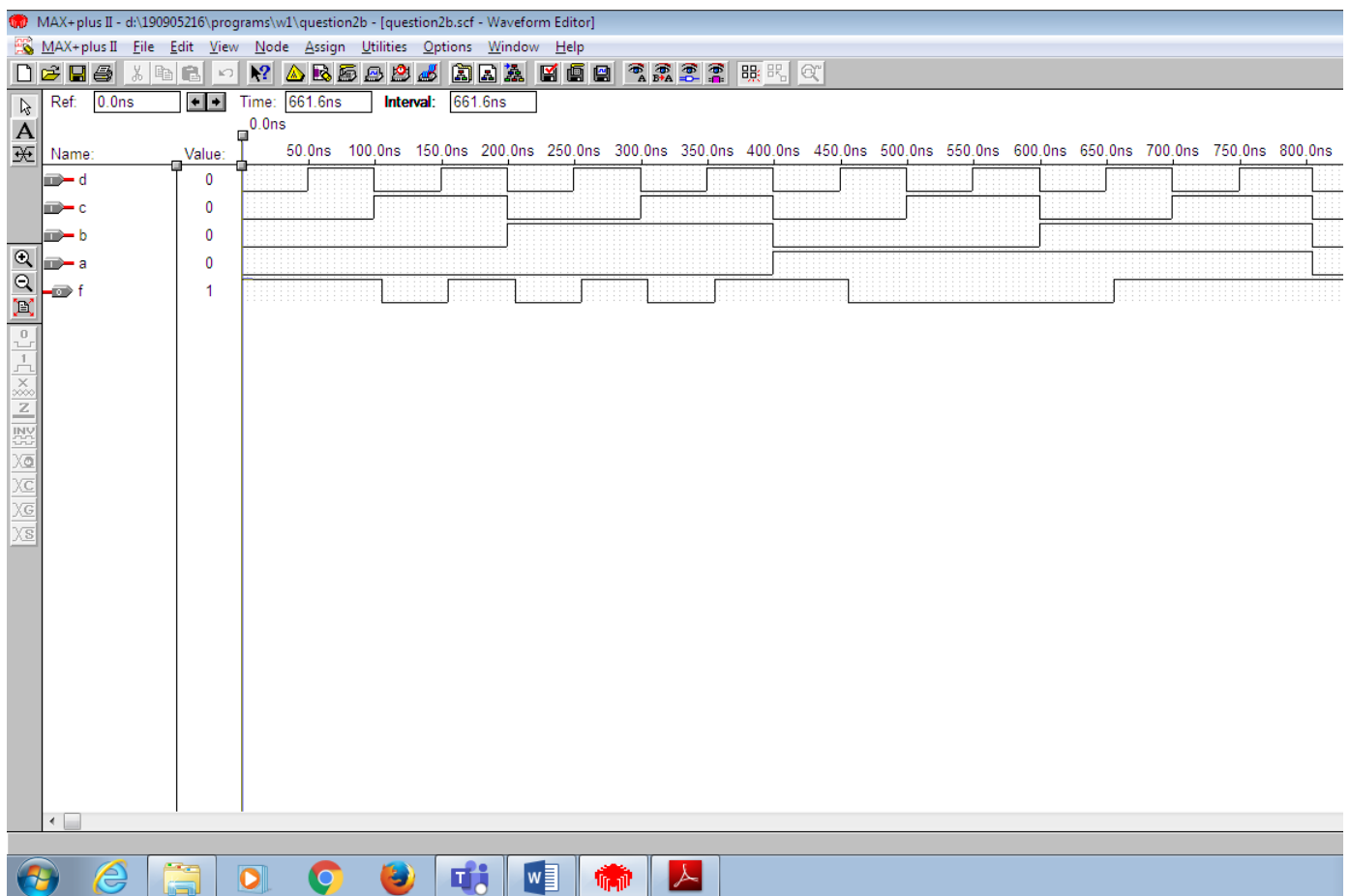
```
module question2b(a,b,c,d,f);
```

```
input a, c, b, d;
```

```
output f;
```

```
assign f = (~a & d) | (~b & ~c & ~d) | (a & b & c);
```

endmodule



### Question3:

```
module question3(a, b, c, d, f);
```

```
input a, b, c, d;
```

```
output f;
```

```
nand(x1, ~a, ~c);
```

```
nand(x2, ~a, d);
```

```
nand(x3, b, ~c);
```

```
nand(x4, b, d);
```

```
nand(f, x1, x2, x3, x4);
```

```
endmodule
```

