## Question B – Daniyar Nazarbayev, H00204990.

1.

```
exception NOT_PERFECT;

exception INFINITE;

fun log2 x = if (x=1) then 0

else if (x=0) then raise INFINITE

else if (x mod 2 <> 0) then raise NOT_PERFECT

else 1+log2(x div 2);
```

2.

```
fun sqrt (x, s) = if ( (s*s)=x orelse (s*s)=(x+1) orelse
(s*s)=(x-1) ) then s

else if (s*s)<x then sqrt(x, (s+1))

else sqrt (x, (s-1));
```

3.

```
exception ZERO;

fun sumSq (n) = if n=1 then 1 else if n=0 then raise ZERO else

(n*n)+sumSq (n-1);
```

4.

```
exception ZERO;

fun sumHalf (n) = if n=1 then (1 div 2) else if n=0 then raise

ZERO else (n div 2) + sumHalf (n-1);
```

5.

```
fun sumF (f,x) = if (x<>0) then f(x) + sumF(f, x-1) else 0;

fun inc x = x +1;
```

6.

```
fun sumF (f,x) = if (x<>0) then f(x) + sumF(f, x-1) else 0;
exception ZERO;
fun sumSq (n) = if n=1 then 1 else if n=0 then raise ZERO else
(n*n)+sumSq (n-1);
```

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7.

```
fun sumF (f,x) = if (x<>0) then f(x) + sumF(f, x-1) else 0;
exception ZERO;
fun sumHalf (n) = if n=1 then (1 div 2) else if n=0 then raise
ZERO else (n div 2) + sumHalf (n-1);
```

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